# Appendix I – ACEC Evaluation

# RELEVANCE AND IMPORTANCE EVALUATION FOR POTENTIAL EXPANSION OF THE KLAMATH CANYON AREA OF CRITICAL ENVIRONMENTAL CONCERN

## INTRODUCTION

In 1986 the Klamath River Canyon, from the J.C. Boyle Powerhouse to the California border from rim to rim, was first nominated for consideration as an Area of Critical Environmental Concern (ACEC) by Kelly O'Brian Smith of the Oregon Chapter of the Sierra Club (November 4, 1986). Subsequent to that were nominations by Marc E. Prevost, Rogue Group Sierra Club (June 2, 1987); Liz Frenkel, Oregon Chapter of the Sierra Club (April 17, 1988); and Bruce W. White, Oregon Chapter of the Sierra Club (April 17, 1988). The signing of the Record of Decision for the Klamath Falls Resource Management Plan designated this area as the Klamath Canyon ACEC on June 2, 1995.

A planning process to develop a resource management plan (RMP) and environmental impact statement (EIS) for the Klamath River was initiated in the spring of 2000. The planning area included not only the area previously designated as an ACEC (Segment 2), but also the Klamath River Canyon from rim to rim from the J. C. Boyle Dam to the J. C Boyle Powerhouse (Segment 1), and the Klamath River Canyon from the California/Oregon border to slackwater of the Copco Reservoir (Segment 3). The interdisciplinary team developing the management plan found that Segment 1 supported similar resource values within Oregon as Segment 2. Therefore, after careful consideration, the BLM interdisciplinary team recommended that Segment 1 be evaluated for inclusion into the Klamath Canyon ACEC during the planning process.

An ACEC designation highlights an area where special management attention is needed by the Bureau of Land Management (BLM) to protect and prevent irreparable damage to important historic, cultural, and scenic values; fish or wildlife resources; or other natural systems or processes; or to protect human life and safety from natural hazards. The ACEC designation indicates to the public that the BLM not only recognizes the area possesses significant values, but has also established special management measures to protect those values. Designation serves as a reminder that the significant values or resources must be accommodated during the BLM's consideration of subsequent management actions and land use proposals near or within an ACEC.

To be considered as a potential ACEC and further analyzed in resource management plan (RMP) alternatives, inventory data must be analyzed to determine whether there are areas containing significant resources, values, systems or processes, or hazards. To be a potential ACEC, an area must meet both relevance and importance criteria, as established and defined in 43 CFR 1610.7-2:

**Relevance.** There shall be present a significant historic, cultural, or scenic value; a fish or wildlife resource or other natural system or process; or natural hazard.

**Importance.** The above described value, resource, system, process, or hazard shall have substantial significance and values. This generally requires qualities of more than local significance and special worth, consequence, meaning, distinctiveness, or cause for concern. A natural hazard can be important if it is a significant threat to human life or property.

The analysis used as a basis for designation of the Klamath Canyon ACEC, considered historic, prehistoric cultural, Native American traditional use (cultural value), scenic, fishery, wildlife, special status plant species (natural process or system), and vegetation (natural process or system) values in the Klamath River Canyon during the process which designated the ACEC. After careful consideration, the BLM interdisciplinary team included the same resource values for evaluation of Segment 1 for inclusion into the Klamath Canyon ACEC.

The designated Klamath Canyon ACEC covers 5,390 acres of land managed by the BLM's Klamath Falls Resource Area (KFRA), and 1,903 acres of state and private land. The Klamath State Scenic Waterway is contained within the boundary of the ACEC. Segment 1 contains 947 acres of land managed by KFRA and 463 acres of private land.

**Map 1-1** shows the general location of the upper Klamath River and **Map 1-2** shows the ACEC boundary (Segment 2 on the map), State Scenic Waterway boundary, and wild and scenic river study area boundary from the 1990 BLM study.

## RELEVANCE

As described in BLM Manual 1613, an area meets the "relevance" criterion if it contains one or more of the following:

1. A significant historic, cultural, or scenic value (including but not limited to rare or sensitive archaeological resources and religious or cultural resources important to Native Americans).

2. A fish and wildlife resource (including but not limited to habitat for endangered, sensitive or threatened species, or habitat essential for maintaining species diversity).

3. A natural process or system (including but not limited to endangered, sensitive, or threatened plant species; rare, endemic, or relic plants or plant communities which are terrestrial, aquatic, or riparian; or rare geologic features).

4. Natural hazards (including but not limited to areas of avalanche, dangerous flooding, landslides, unstable soils, seismic activity, or dangerous cliffs). A hazard caused by human action may meet the relevance criteria if it is determined through the RMP process that it has become part of a natural process.

### Historic Values

**Segment 1.** The Topsy Road, an excellent example of an early stagecoach/freight road, passed through this segment. This road was first constructed in 1873 along the general route of an Indian trail. From 1875 to 1903 the road provided the only year round freight and passenger transportation to the Klamath Basin. Although stage and freight service along the Topsy Road was displaced by the railroad in 1903, the road served as the only automobile route to Klamath Falls until 1922. The road has considerable historic importance to the development of the transportation of the region. Portions of the Topsy Road are eligible for nomination to the National Register of Historic Places.

**Conclusion.** The historic values in Segment 1 satisfy the criterion for relevance.

### Cultural Values

#### Prehistoric Values

**Segment 1.** There is one known prehistoric site, which lies above the powerhouse.

#### Native American Traditional Use Values

The Klamath River Canyon is valued as a cultural landscape, which holds great spiritual and religious significance for the Klamath Tribes and the Shasta Nation. The physical environment of the canyon is the core of tribal spiritualism. It has been and still is used for spiritual activities such as vision quests, curing ceremonies, and spiritual preparation; as well as for cultural activities such as hunting, fishing, gathering, and education.

Both the prehistoric values and the Native American traditional use of the canyon were found to be outstandingly remarkable values in the Final Eligibility and Suitability Report for the Upper Klamath Wild and Scenic River Study (BLM 1990).

**Conclusion.** The cultural values in Segment 1, both prehistoric resources and Native American traditional use, meet the criterion for relevance.

### Scenic Values

The scenic quality rating of the upper Klamath River Canyon (from Topsy campground to Copco Reservoir) has been classified as Scenic Quality A, BLM's highest scenic classification (BLM 1977 and 1988). This rating of outstanding scenic value is due primarily to unique landform, diverse vegetation, water, and a low level of adverse cultural

modifications (for the entire canyon's length). All three river segments are to be managed to maintain the existing character of the landscape, using VRM Class II standards (BLM Klamath Falls and Redding RMPs).

The canyon represents a transition from a mountainous to desert landscape as it crosses the Cascade Range, creating unique and varied scenery. The canyon is characterized by steep, layered basalt walls, rising as high as 1,000 feet above the river, providing a strong contrast to the regular rolling topography of the surrounding plateau.

Vegetation in the canyon is diverse due to elevation differences, slope, aspect, and soil diversity. Colors within the canyon are heavily influenced by the vegetation. The prominence of colors is most obvious in the fall when the leaves of the deciduous trees change colors adding reds and yellows to the landscape. During spring and early summer, flowering brush, and wildflowers enhance the color contrast, as does the white of the winter snows.

In 1988 the upper Klamath River, from J.C. Boyle powerhouse to the Oregon/California state line (segment 2), was designated an Oregon State Scenic Waterway. The scenic values of the Klamath River Canyon (segment 2 and 3) were found to be an outstandingly remarkable value in the Final Eligibility and Suitability Report for the Upper Klamath Wild and Scenic River Study (BLM 1990). In 1994, the upper Klamath River, from just below the J.C. Boyle powerhouse, to the Oregon/California state line, was designated a federal Wild and Scenic River.

**Segment 1.** The scenic values found in segment 1 (Bypass Reach) are relevant in that they are intricately linked and add to the diversity and complexity of landscape variation found in segment 2 (Wild and Scenic River segment). The opportunity to travel down into a semi-primitive canyon on an improved road provides appealing scenic vistas for both first time and repeat recreational visitors. Visitors witness a dramatic change in vegetation, color, textures and landforms as they travel from the Klamath Basin plateau to the bottom of the river canyon in Segment 1. Visitors are in essence able to traverse back in time as they descend into the canyon Visitors pass through multiple, older layers of volcanic lava, ash, cinders and other eruptions from ancient Cascade volcanoes.

The opportunity to provide additional protection and special management attention for the scenic resources found in segment 1 is important. Cultural modifications such as hydroelectric facilities and roads have significantly affected this segment of the river and are disharmonious with the existing scenery. The opportunity to provide significant scenic improvement enhancements to these existing cultural modifications and improve the present landscape is an important consideration for future management.

**Conclusion.** The presence of significant scenic values in Segment 1meets the criterion for relevance.

## Fish

The population of native inland redband trout that inhabits all three segments of the river is a significant resource. This population is very abundant, naturally spawning, and genetically unique in being resistant to high Ph values. Their resistance to a lethal parasite and high summer water temperatures may also be a genetic trait. Non-native strains of rainbow trout historically introduced in the upper Klamath River apparently were not able to reproduce due to their susceptibility to these conditions. The inland redband trout is a Species of Concern for the U.S. Fish and Wildlife Service (USFWS), a state of Oregon vulnerable species, and a Bureau sensitive species.

The fish resources were found to be an outstandingly remarkable value in the Final Eligibility and Suitability Report for the Upper Klamath Wild and Scenic River Study (BLM 1990).

**Segment 1.** This segment is a cold water refugia for resident trout, a source for downstream populations of wild trout, a designated wild trout river in Oregon, and the springs in the reach provide a source of high quality water to the river. The Klamath largescale sucker, a Species of Concern for the USFWS and a Bureau sensitive species, is also found in this segment.

**Conclusion.** The presence of the native inland redband trout and Bureau sensitive species in Segment 1 satisfies the relevance criterion for fish.

## Wildlife Resources

The rich diversity of wildlife, including threatened and endangered species, found within this relatively small confined geographic area is unique. There are 32 species of herptiles, 67 species of mammals, and 212 species of birds that potentially occur within the canyon area. Of these, there are two federally listed threatened species and 56 special status species on federal or state lists.

A maternity colony of Townsend's big-eared bat, a Bureau sensitive species and Oregon state sensitive (critical) species, is documented within the designated ACEC in Segment 2. There are only five known maternity colonies within the region. These bats likely forage throughout the Klamath Canyon, including Segment 1.

Wildlife habitat within the proposed ACEC addition is of exceptionally high quality and diversity, as evidenced by the numbers and diversity of wildlife living in and migrating through the area. The Klamath River Canyon bisects the Cascade Range and cuts through a variety of plant communities, which creates the wide diversity of habitats available for wildlife.

The most important habitat features in Segment 1 include the riverine habitat that is important to a wide variety of birds and mammals including bald eagles, osprey, ringtails, and river otters; the canyon provides a natural migration corridor for a variety of raptors; the extensive rimrock is important raptor nesting habitat; large live and dead conifers provide nesting and roosting habitat for bald eagles and ospreys; caves provide important nursery and roosting habitat for several species of bats. These habitats are equally important during the winter period.

The wildlife resources (both the animals and the habitat) were found to be an outstandingly remarkable value in the Final Eligibility and Suitability Report for the Upper Klamath Wild and Scenic River Study (BLM 1990).

**Conclusion.** The presence and significance of both the populations and habitat of many federal and state threatened, endangered, sensitive, and candidate wildlife species that live in or migrate through the upper Klamath River Canyon satisfies the criterion for relevance for Segment 1.

## Natural Processes and Systems

### Geology

The upper Klamath River is in a transition area between the High Cascades and Basin and Range physiographic provinces. Characteristic geologic features are primarily volcanic flows and volcanic-derived sedimentary rocks. There are some spectacular high basalt and andesite cliffs that contain good examples of columnar jointing. Other interesting geologic features include weathered tuff cliffs, the Salt Caves, localized outcrops of contrasting white diatomaceous earth (diatomite), and landslide features.

### Vegetation

The proposed addition to the Klamath Canyon ACEC supplements the wide diversity of plant communities, which occur there due to variations in topography, aspect, elevation, soil type, and microclimate provided by the canyon, which bisects the Cascade Range traversing several distinct vegetation zones. Vegetation community types range from montane conifer forest communities to high desert communities, and from riparian communities to oak savannah communities.

This diversity of plant communities was a major contributing factor in finding both the wildlife habitat and visual resources values in the canyon to be outstandingly remarkable values in the Final Eligibility and Suitability Report for the Upper Klamath Wild and Scenic River Study (BLM 1990).

### Special Status Plant Species

**Segment 1.** Two populations of red-root yampah (*Perideridia erythrorhiza*), a Bureau sensitive species, are documented within Segment 1. Red-root yampah is also a State of Oregon candidate for listing as threatened or endangered, and is on List 1, taxa threatened or endangered throughout its range, of the Oregon Natural Heritage Program (ONHP).

**Conclusion.** The relevance criterion for the occurrence of a natural process or system in Segment 1 is met. Although the geologic features are interesting and enhance the visual resources, they are not rare, and therefore do not meet the relevance criterion. The presence of habitat for endangered, sensitive, or threatened plant species meets the criterion for relevance. The vegetation values meet the criterion of relevance by increasing the wide diversity of plant communities, and by providing habitat essential for maintaining wildlife species diversity.

## Natural Hazards

**Segment 1.** Natural hazards in Segment 1 include landslides, rockfalls, and the river itself. Seismic (earthquake) activity is low.

**Conclusion.** The relevance criterion for natural hazards only requires an area to contain hazards; therefore, the presence of landslides, rockfalls, and the river in this segment meets the criterion for relevance.

## IMPORTANCE

The value, resource, system, process, or hazard described under the Relevance Criterion must have substantial significance and value to satisfy the importance criteria. This generally means that the value, resource, system, process, or hazard is characterized by one or more of the following:

1. Has more than locally significant qualities which give it special worth, consequence, meaning, distinctiveness, or cause for concern, especially compared to any similar resource.

2. Has qualities or circumstances that make it fragile, sensitive, rare, irreplaceable, exemplary, unique, endangered, threatened, or vulnerable to adverse change.

3. Has been recognized as warranting protection to satisfy national priority concerns or to carry out the mandates of the Federal Land Policy and Management Act.

4. Has qualities that warrant highlighting to satisfy public or management concerns about safety and public welfare.

5. Poses a significant threat to human life and safety or to property.

## Historic Values

**Segment 1.** The Topsy Road was the major route of transportation into the Klamath Basin in the late 1800s to early 1900s. The Topsy Road has been preserved in large part due to its isolation. There are relatively few important 19th century travel routes, which remain in a relatively unaltered state in the region, which gives the Topsy Road more than local significance.

**Conclusion.** The historic values in Segments 1 have more than local significance, are fragile, irreplaceable, unique, and endangered. For these reasons they meet the importance criterion.

## Cultural Values

### Prehistoric Values

The prehistoric resources in the Klamath River Canyon have been deemed significant because of the abundance of sites and their regional interpretive value. A wide range of artifacts recovered from sites within the canyon has shown the river corridor was not the exclusive territory of one tribe but was used at various times, perhaps concurrently, by the Shasta, Modoc, Klamath, Takelma, and possibly the Achomawi of northeastern California. This is important because it raises some interesting questions about tribal boundary fluctuation not only within the canyon, but within the region as well. This lends more than local significance to the cultural values.

Archaeological sites are by their nature fragile, sensitive, irreplaceable, and endangered.

Native American Traditional Use

Native American traditional use of the canyon is one of its most unique values. Members of the Shasta Nation and Klamath Tribes state that the canyon is sacred and of immeasurable spiritual significance. The spiritual importance of the canyon is associated with the preservation of the river and the canyon's physical environment, as well as ancestral and current use by tribal members. Significant alteration of the canyon could destroy it as a suitable focus of Native American activity.

Spiritual power is vested in the environment. Encompassed within its boundaries are places and things, such as wildlife, vegetation, springs, rapids, boulders, caves, and cliffs that contribute to the spiritual importance of the canyon. The diversity of resources found within the canyon is rare, and the interrelationship of these same values is fragile. These resources make up the canyon's physical environment and the preservation of these resources as a whole is vital to the Shasta and Klamath people.

**Conclusion.** The prehistoric values within Segment 1 are rare, fragile, sensitive, irreplaceable, endangered, and have more than local significance. The traditional use of the canyon by Native Americans has more than local significance, which gives it special worth, meaning, and distinctiveness; and has qualities that make it irreplaceable, unique, and vulnerable to adverse change. The prehistoric values and Native American traditional use within Segment 1 meet the criterion for importance.

## Scenic Values

**Segment 1.** The scenic quality rating of the upper Klamath River Canyon has been classified as Scenic Quality A, BLM's highest scenic classification (BLM 1977 and 1988). However, significant negative cultural modifications affect the present scenery found in Segment 1. When taken in context with the scenery found in and connectivity with Segment 2 and 3 and the fact that Segment 1 provides the primary travel corridor for thousands of recreation visitors to the canyon in Segment 2 and 3, the protection and enhancement of scenery in Segment 1 is important.

The steep walled canyon is the predominant visual element in the region. The layered basalt walls rise up to 1,000 feet above the river. Vegetative variety is much more diverse than the surrounding plateau due to the variety of elevations, aspects, and slopes. The Klamath River itself enhances the visual variety in the canyon. As it flows through the deep canyon, it changes from slack, slow-flowing waters in the wider areas to a rushing torrent of cascading whitewater through narrow rocky walls making it a unique sight in the region.

**Conclusion.** The scenic values in Segment 1 are unique in the region, have more than local significance, and are vulnerable to adverse change. They meet the criterion of importance.

## Fish

**Segment 1**. This segment was designated in 1978 as a wild rainbow trout stream by the Oregon Department of Fish and Wildlife and is one of only six rivers in Oregon managed for wild rainbow trout.

The National Park Service in its Nationwide Rivers Inventory recognized the "excellent trout fishery" of the Klamath River.

The Northwest Power Planning Council designated the upper Klamath River as a Protected Area to protect the resident inland redband trout population.

The Oregon Department of Fish and Wildlife chose the inland redband trout populations of the Klamath Basin, including the upper Klamath River, as among the first in the state to be studied to better understand how stocks of wild trout have adapted to their particular environments.

The Pacific Northwest Rivers Study for Oregon gave their highest resource value rating based on the wild trout population.

The catch rate for wild rainbow trout on the upper Klamath River, is rivaled in Oregon only by that in the Deschutes River. The river's reputation for producing large wild rainbow trout draws anglers from outside the region who come to fish for more than one day.

The Klamath largescale sucker, a Bureau sensitive species, has been found in Segment 1.

**Conclusion.** The inland redband trout population of the upper Klamath River is unique, fragile, sensitive, and vulnerable to adverse environmental change. The Klamath largescale sucker is a Bureau sensitive species. Fish resources (including both the wild trout and the sucker) in the proposed addition to the ACEC, which are more than locally significant and have been recognized as warranting protection, meet the criterion for importance.

## Wildlife Resources

The Klamath River is one of three rivers that cuts through the Cascade Range, which makes it a natural and important migratory route for wildlife. The diversity of habitat and the wide variety of threatened and endangered and other wildlife species present is unique and not found anywhere else in the region.

Within the canyon as a whole, there are two federally listed threatened species; two federal candidate species; nine state listed threatened, endangered, and/or sensitive species; and two Oregon Natural Heritage Program listed species known to occur. An additional six federal and state listed species potentially occur in the Klamath River Canyon.

**Conclusion.** The wildlife habitat and population values in Segment 1 of the canyon are unique and have more than local significance. Several of the species within the canyon are threatened, endangered, or sensitive, and would be vulnerable to adverse change. They satisfy the importance criterion.

## Natural Processes and Systems

### Geology

The upper Klamath River is in a transition area between the High Cascades and Basin and Range physiographic provinces. Characteristic geologic features are primarily volcanic flows and volcanic-derived sedimentary rocks. There are some spectacular high basalt and andesite cliffs that contain good examples of columnar jointing. Other geologic features include weathered tuff cliffs, the Salt Caves, localized outcrops of contrasting white diatomaceous earth (diatomite), and landslide features.

### Vegetation

The Klamath and Pit rivers are the only rivers to bisect the Cascade Range in the southern Oregon/northern California area. The diversity of plant communities in the Klamath Canyon is not duplicated elsewhere. Only one other river, the Columbia, flows through the Cascades, but crosses a different group of vegetation zones and thus does not duplicate the diversity of species, communities, and habitats found in the Klamath Canyon.

### Special Status Plant Species

**Segment 1.** The status of red-root yampah (*Perideridia erythrorhiza*) as state candidate species indicates that it is vulnerable to threats to its existence throughout Oregon. The inclusion of this species on List 1 of the Oregon Natural Heritage Program indicates that it is threatened or endangered throughout its entire range.

**Conclusion.** The importance criterion for a natural process or system is met. The geologic features are not more than locally significant, exemplary, or unique to this area; therefore, they do not meet the importance criterion. The presence red-root yampah in Segment 1 is of more than local significance, and thus the special status plant species values meet the criterion for importance. The vegetation in the upper Klamath River Canyon, which provides a wide diversity of plant and animal species, communities, and habitats, is unique and of more than local significance; therefore, it meets the criterion for importance.

## Natural Hazards

Natural hazards in the upper Klamath River study area include landslides, rockfalls, and the river itself. Seismic (earthquake) activity is low.

**Conclusion.** None of the natural hazards in the proposed ACEC pose a significant threat to human life and safety, or to property; therefore, they do not meet the importance criterion.

## SUMMARY

It is only necessary to meet the relevance and importance criteria for one value to be designated an ACEC. Segment 1 of the upper Klamath River Canyon has been found to meet the relevance criterion for the presence of historic, cultural (both prehistoric values and Native American traditional use), and scenic values; fish and wildlife (both populations and habitat) resources; a natural process or system (both priority plant species and vegetation); and natural hazards (landslides, rockslides, and the river itself). The Klamath Canyon has been found to meet the importance criterion for substantial significance and value of all the features mentioned above, except natural hazards.

## CONCLUSION

Segment 1 of the upper Klamath River Canyon, and from rim to rim, meet the criteria and are identified as a potential addition to an area of critical environmental concern. The described area is recommended for further evaluation as an addition to an area of critical environmental concern in the Upper Klamath River Management Plan. This land use planning process is currently underway.

Under management direction in the existing land use plan (Klamath Falls Resource Area Resources Management Plan), the identified relevant and important values within the proposed addition to the ACEC are adequately protected from degradation. No special temporary management actions will be required until the area is fully evaluated in the Upper Klamath River Management Plan and Environmental Impact Statement. At that time the record of decision for the final management plan will replace management actions in the Klamath Falls Resource Area RMP.

# Appendix J – Plant Species List

**Working Plant List For The Upper Klamath River Canyon Vicinity**
with USGS Quadrangle Map Locations noted (Section from the backwaters of Copco Reservoir, CA, to J.C. Boyle Reservoir, OR)

**TREES**

BETULACEAE
*Alnus rhombifolia* (white alder) CH, MH, SS
*Betula occidentalis* (western birch) CH, MH, SS

CUPRESSACEAE
*Calocedrus decurrens* (incense cedar) CH, MH, SS
*Juniperus occidentalis* var. *occidentalis* (western juniper) CH, MH, SS

FAGACEAE
*Quercus garryana* var. *garryana* (Oregon white oak) CH, MH, SS
*Quercus kelloggii* (California black oak) CH, MH, SS

OLEACEAE
*Fraxinus latifolia* (Oregon ash) CH, MH, SS

PINACEAE
*Abies concolor* var. *lowiniana* (white fir) CH, MH, SS
*Pinus contorta* ssp. *murrayana* (lodgepole pine) CH, MH
*Pinus lambertiana* (sugar pine) CH, MH, SS
*Pinus ponderosa* (ponderosa pine) CH, MH, SS
*Pseudotsuga menziesii* var. *menziesii* (Douglas-fir) CH, MH, SS

SALICACEAE
*Populus balsamifera* ssp. *trichocarpa* (black cottonwood) SS
*Populus tremuloides* (quaking aspen) CH, MH
*Salix laevigata* (red willow) CH, MH, SS
*Salix lucida* ssp. *lasiandra* (shining willow) CH, MH, SS
*Salix lutea* (yellow willow) CH, SS

**SHRUBS AND VINES**

ANACARDIACEAE
*Rhus trilobata* (three-leaf sumac) MH, SS
*Toxicodendron diversilobum* (poison oak) CH, MH, SS

ASTERACEAE
*Artemisia arbuscula* ssp. *thermopola* (low sagebrush) CH, MH, SS
*Artemisia cana* ssp. *bolanderi* (silver sagebrush) CH, MH
*Artemisia tridentata* ssp. *tridentata* (Great Basin sagebrush) CH, MH
*Artemisia tridentata* ssp. *vaseyana* (big sagebrush) CH
*Chrysothamnus nauseosus* ssp. *consimilis* (rabbit brush) CH, MH, SS
*Chrysothamnus viscidiflorus* ssp. *viscidiflorus* (green rabbit brush) CH, MH, SS
*Ericameria bloomeri* (goldenbush) CH, MH, SS

BERBERIDACEAE
*Berberis aquifolium* var. *aquifolium* (Oregon grape) CH, MH, SS
*Berberis aquifolium* var. *repens* (creeping Oregon grape) CH, MH, SS
*Berberis nervosa* (Oregon grape) MH

BETULACEAE
*Alnus incana* ssp. *tenuifolia* (mountain alder) CH
*Alnus viridis* ssp. *sinuata* (thin-leaf alder) MH

CAPRIFOLIACEAE
*Lonicera ciliosa* (orange honeysuckle) CH, MH, SS
*Lonicera interrupta* (chaparral honeysuckle) CH, MH, SS
*Lonicera* sp. (introduced honeysuckle) CH
*Sambucus mexicana* (blue elderberry) CH, MH, SS
*Symphoricarpos albus* var. *laevigatus* (snowberry) CH, MH, SS
*Symphoricarpos mollis* (creeping snowberry) CH, SS
*Symphoricarpos rotundifolius* var. *rotundifolius* (mountain snowberry) SS

CELASTRACEAE
*Paxistima myrsinites* (mountain lover, Oregon boxwood) CH, MH, SS

CHENOPODIACEAE
*Sarcobatus vermiculatus* (greasewood) MH

CORNACEAE
*Cornus glabrata* (smooth dogwood) CH, SS
*Cornus sericea* ssp. *sericea* (red-twig dogwood) CH, MH

ERICACEAE
*Arctostaphylos nevadensis* (pine-mat manzanita) CH, MH
*Arctostaphylos patula* (greenleaf manzanita) CH, MH, SS
*Arctostaphylos viscida* ssp. *viscida* (white-leaf manzanita) CH, MH
*Chimaphila umbellata* (prince's pine) CH, MH

FABACEAE
*Cytisus scoparius* (scotch broom) CH
*Lupinus albifrons* var. *douglasii* (lupine) CH, MH

FAGACEAE
*Chrysolepis chrysophylla* var. *minor* (chinquapin) CH, MH, SS
*Quercus garryana* var. *breweri* (scrub Oregon white oak) CH, MH

GARRYACEAE
*Garrya fremontii* (Fremont's silk-tassle) MH, SS

GROSSULARIACEAE
*Ribes aureum* var. *aureum* (golden currant) CH, MH
*Ribes binominatum* (Siskiyou gooseberry) MH
*Ribes cereum* var. *cereum* (wax currant) CH, MH
*Ribes divaricatum* var. *pubiflorum* (gooseberry) CH, SS
*Ribes hudsonianum* var. *petiolare* (western black currant) SS
*Ribes inerme* var. *inerme* (white-stemmed gooseberry) CH, MH, SS
*Ribes lobbii* (gummy gooseberry) CH, SS
*Ribes sanguineum* var. *sanguineum* (red-flowering currant) CH, SS
*Ribes velutinum* (plateau gooseberry) CH, MH, SS

PHILADELPHACEAE
*Philadelphus lewisii* (Lewis' mockorange) CH, MH, SS

POLYGONACEAE
*Eriogonum sphaerocephalum* var. *halimioides* (wild buckwheat) CH, MH, SS
*Eriogonum umbellatum* var. *polyanthum* (sulfur flower) CH, MH

RANUNCULACEAE
*Clematis ligusticifolia* (clematis) CH, SS

RHAMNACEAE
*Ceanothus cuneatus* var. *cuneatus* (buckbrush) CH, MH, SS
*Ceanothus cuneatus* x *prostratus* (hybrid ceanothus) CH, MH
*Ceanothus integerrimus* (deerbrush) CH, MH, SS
*Ceanothus prostratus* (mahala mat) CH, IG, K, MH, PM, SN, SS, SoM, SC, SuM
*Ceanothus velutinus* var. *velutinus* (snowbrush) CH, MH
*Rhamnus purshiana* (cascara) CH, SS
*Rhamnus rubra* (sierra coffeeberry) CH

ROSACEAE
*Amelanchier utahensis* (Utah serviceberry) CH, MH, SS
*Cercocarpus betuloides* var. *betuloides* (mountain mahogany) CH, MH, SS
*Cercocarpus betuloides* var. *macrourus* CH, MH, SS
*Cercocarpus ledifolius* var. *intermontanus* (curl-leaf mountain mahogany) CH
*Crataegus douglasii* (black hawthorn) CH, SS
*Holodiscus discolor* (oceanspray) CH, SS
*Holodiscus microphyllus* var. *glabrescens* (rock spirea) MH
*Malus fusca* (Oregon crab apple) MH
*Physocarpus capitatus* (ninebark) SS
*Prunus emarginata* (bittercherry) CH, MH
*Prunus subcordata* (Klamath plum) CH, MH, SS
*Prunus virginiana* var. *demissa* (chokecherry) CH, MH, SS

*Purshia tridentata* var. *tridentata* (antelope brush) CH, MH, SS
*Rosa californica* (California rose) CH, MH, SS
*Rosa gymnocarpa* (bald-hip rose) CH, MH, SS
*Rosa woodsii* var. *ultramontana* (Woods' rose) CH, MH, SS
*Rosa* x "harrisonian" (pioneer rose) CH
*Rubus discolor* (Himalayan blackberry) CH, MH, SS
*Rubus laciniatus* (cut-leaved blackberry) CH, SS
*Rubus leucodermis* (black raspberry, blackcap) CH, MH, SS
*Rubus parviflorus* (thimbleberry) CH, MH, SS
*Rubus ursinus* (Pacific blackberry) CH, SS
*Spiraea douglasii* (Douglas' spirea) CH, MH, SS

SALICACEAE
*Salix exigua* (narrow-leaf willow) CH, SS
*Salix scouleriana* (Scouler's willow) CH, MH, SS

SOLANACEAE
*Lycium barbarum* (matrimony vine) CH

VITACEAE
*Vitis californica* (western wild grape) CH, MH, SS

**HERBACEOUS PLANTS**

ALISMATACEAE
*Alisma plantago-aquatica* (water plantain) CH
*Sagittaria cuneata* (arrowhead, wapato) CH

AMARANTHACEAE
*Amaranthus retroflexus* (green amaranth) SS

APIACEAE
*Angelica arguta* (angelica) MH
*Angelica hendersonii* (angelica) CH
*Anthriscus caucalis* (bur-chervil, Klingons) CH, MH, SS
*Berula erecta* (cut-leaf water parsnip) CH, MH
*Cicuta douglasii* (western water hemlock) MH, SS
*Conium maculatum* (poison hemlock) CH, MH, SS
*Daucus carota* (wild carrot, Queen Anne's lace) CH, MH
*Heracleum lanatum* (cow parsnip) CH
*Lomatium bicolor* var. *leptocarpum* (lomatium) CH, MH, SS
*Lomatium californicum* (iknish, California lomatium) CH, MH, SS
*Lomatium dissectum* var. *mallifidum* (fern-leaf lomatium) CH, MH
*Lomatium macrocarpum* (large-seeded lomatium) CH, MH, SS
*Lomatium nudicaule* (pestle lomatium) CH, MH, SS
*Lomatium piperi* (Piper's lomatium) CH, MH
*Lomatium triternatum* var. *triternatum* (nine-leafed lomatium) CH, MH, SS
*Lomatium vaginatum* (lomatium) CH, MH, SS
*Osmorhiza occidentalis* (western sweet cicely) CH
*Osmorhiza purpurea* (sweet cicely) CH, MH, SS
*Perideridia bolanderi* ssp. *bolanderi* (Bolander's yampa) CH, MH, SS
*Perideridia erythrorhiza* (red-root yampa) CH, MH, SS
*Perideridia gairdneri* ssp. *borealis* (Gairdner's yampa) CH, MH
*Perideridia howellii* (Howell's yampa) CH, MH
*Perideridia oregana* (ipos, yampa) CH, MH, SS
*Sanicula graveolens* (snakeroot, poison sanicle) CH, MH, SS
*Yabea microcarpa* CH

APOCYNACEAE
*Apocynum androsaemifolium* (bitter dogbane) CH, MH, SS
*Apocynum cannabinum* (Indian hemp) CH, SS

ASCLEPIADACEAE
*Asclepias cordifolia* (heart-leaf milkweed) MH
*Asclepias fascicularis* (narrow-leaf milkweed) MH, SS
*Asclepias speciosa* (common milkweed) CH, MH, SS

ASTERACEAE
*Achillea millefolium* var. *lanulosa* (common yarrow) CH, MH, SS
*Acroptilon repens* (Russian knapweed) CH
*Adenocaulon bicolor* (trail plant) MH
*Ageratina occidentalis* CH
*Anaphalis margaritacea* (pearly everlasting) CH, MH
*Ancistrocarphus filagineus* (wooly fishhooks) MH, PM

*Antennaria argentea* CH
*Antennaria dimorpha* CH, MH
*Antennaria howellii* ssp. *howellii* CH, MH
*Antennaria rosea* ssp. *rosea* CH, MH
*Anthemis cotula* (dog-fennel) CH, MH, SS
*Arctium minus* (burdock) CH, MH, SS
*Arnica cordifolia* (heart-leafed arnica) CH, SS
*Artemisia douglasiana* (mugwort) CH, MH, SS
*Aster campestris* (aster) CH
*Aster lanceolatus* ssp. *hesperius* CH
*Aster ledophyllus* CH, MH
*Balsamorhiza deltoidea* (deltoid balsamroot) CH, MH, SS
*Balsamorhiza sagittata* (arrow-leaf balsamroot) CH, MH
*Bidens cernua* var. *cernua* (nodding bur-marigold) SS
*Blepharipappus scaber* (rough eyelash) CH, MH, SS
*Centaurea nigra* CH
*Centaurea solstitialis* (yellow star-thistle) CH, MH, SS
*Centaurea squarrosa* (knapweed) CH
*Chaenactis douglasii* var.? (dusty maiden) SS
*Chamomilla suaveolens* (pineapple weed) MH, SS
*Cichorium intybus* (chicory) MH, SS
*Cirsium cymosum* (peregrine thistle) CH
*Cirsium occidentale* var. *candissimum* (snowy thistle) SS
*Cirsium vulgare* (bull thistle) CH, MH, SS
*Conyza canadensis* (horseweed) CH
*Crepis occidentalis* CH
*Crocidium multicaule* (spring-gold) CH
*Echinops sphaerocephalus* (globe thistle) CH, MH, SS
*Erigeron strigosus* CH
*Eriophyllum lanatum* var. *integrifolium* (woolly sunflower) CH, MH, SS
*Euthamia occidentalis* (western goldenrod) CH, MH, SS
*Grindelia nana* (gumweed) CH
*Helenium bigelovii* (Bigelow's sneezeweed) CH, MH
*Helianthus bolanderi* (Bolander's sunflower) MH
*Hieracium albiflorum* (white flowered hawkweed) CH, MH, SS
*Lactuca saligna* CH, SS
*Lactuca serriola* (prickly lettuce) CH, SS
*Leucanthemum vulgare* (ox-eye daisy) MH, SS
*Madia citriodora* (lemon-scented tarweed) CH
*Madia elegans* ssp. *elegans* (elegant tarweed) CH, MH, SS
*Madia elegans* ssp. *vernalis* (spring-blooming elegant tarweed) CH
*Madia exigua* (threadstem madia) CH, MH, SS
*Madia glomerata* (mountain tarweed) CH
*Madia gracilis* (slender tarweed) MH, SS
*Madia minima* (small tarweed) CH, MH
*Microseris nutans* SS
*Nothocalais troximoides* (false agoseris) MH
*Psilocarphus tenellus* var. *tenellus* (woolly-heads) MH
*Scorzonera hispanica* (Spanish salsify, viper's grass) CH
*Senecio aronicoides* (California butterweed) CH
*Senecio integerrimus* var. *exaltatus* (ragwort) CH, MH
*Solidago californica* (California goldernrod) CH, MH

*Sonchus asper* ssp. *asper* (prickly sow thistle) MH
*Stephanomeria tenuifolia* (wire lettuce) CH, MH, SS
*Taraxacum officinale* (dandelion) CH, MH, SS
*Tragopogon dubius* (yellow salsify) CH, MH, SS
*Wyethia angustifolia* (narrow-leaf mule's ears) CH, MH, SS

BORAGINACEAE
*Amsinckia menziesii* var. *intermedia* (fiddleneck) CH, MH, SS
*Cryptantha* sp. CH
*Cynoglossum occidentale* (hound's tongue) CH, MH

BRASSICACEAE
*Alyssum alyssoides* CH, MH
*Arabidopsis thaliana* (mouse-ear cress, thale cress) MH
*Arabis holboellii* var. *pinetorum* (Holboell's rockcress) CH
*Athysanus pusillus* (sandweed) MH, SS
*Barbarea orthoceras* (American wintercress) CH, MH
*Brassica nigra* (black mustard) CH, MH
*Descurainia incisa* ssp. *incisa* (tansy mustard) CH, SS
*Descurainia sophia* (tansy mustard) CH
*Draba verna* (Whitlow grass) CH, MH
*Idahoa scapigera* (flat-pod) CH, MH, SS
*Isatis tinctoria* (dyer's woad) MH
*Lepidium campestre* (poorman's peppergrass) CH, MH, SS
*Lepidium montanum* var. *canescens* CH
*Phoenicaulis cheiranthoides* (dagger-pod) CH, MH
*Rorippa nasturtium-aquaticum* (watercress) CH, MH
*Sisymbrium altissimum* (tumble mustard) CH, SS
*Thelypodium howellii ssp. howellii* MH

CAMPANULACEAE
*Campanula scouleri* (Scouler's harebell) MH
*Downingia bacigalupii* (downingia) CH, MH
*Downingia yina* MH

CARYOPHYLLACEAE
*Arenaria serpyllifolia* ssp. *serpyllifolia* (sandwort) SS
*Cerastium glomeratum* (mouse-ear chickweed) CH, MH, SS
*Holosteum umbellatum* ssp. *umbellatum* (jagged chickweed) CH, MH
*Minuartia douglasii* (sandwort) MH
*Pseudostellaria jamesiana* CH, SS
*Scleranthus annuus* ssp. *annuus* (knawel) MH, SS
*Silene gallica* (pioneer flower) SS
*Silene lemmonii* CH, MH, SS
*Stellaria media* (common chickweed) CH

CHENOPODIACEAE
*Chenopodium album* (lamb's quarters) MH, SS
*Chenopodium ambrosioides* (Mexican tea) CH, MH, SS

CONVOLVULACEAE
*Calystegia occidentalis* ssp. *occidentalis* CH, MH, SS
*Convolvulus arvensis* (morning glory) CH, MH, SS

CRASSULACEAE
*Sedum stenopetalum* (worm-leaf stonecrop) CH, MH, SS

CUSCUTACEAE
*Cuscuta californica* var. *californica* (dodder) CH

DIPSACACEAE
*Dipsacus fullonum* (teasel) CH, MH, SS

ERICACEAE
*Pterospora andromedea* (pine drops) CH, MH
*Pyrola picta* (white-veined wintergreen) CH, MH

EUPHORBIACEAE
*Chamaesyce glyptosperma* (spurge) CH, MH, SS
*Eremocarpus setigerus* (dove weed, turkey mullein) CH, MH, SS

FABACEAE
*Astragalus accidens* var. *hendersonii* (loco-weed) CH
*Astragalus obscurus* (loco-weed) MH
*Lotus corniculatus* (bird's-foot trefoil) MH, SS
*Lotus crassifolius* var. *crassifolius* CH
*Lotus micranthus* MH
*Lotus purshianus* var. *purshianus* (Spanish lotus) CH, MH, SS
*Lotus wrangelianus* CH, MH
*Lupinus argenteus* var. *argenteus* CH, MH
*Lupinus argenteus* var. *heteranthus* CH
*Lupinus polyphyllus* var. *pallidipes* MH
*Lupinus tracyi* (Tracy's lupine) CH, MH
*Medicago lupulina* (black medick) CH, MH, SS
*Medicago polymorpha* (California bur-clover) SS
*Medicago sativa* (alfalfa) CH
*Melilotus alba* (white sweet clover) CH, MH, SS
*Melilotus indica* (sour clover) MH
*Melilotus officinalis* (yellow sweet clover) CH, MH
*Trifolium bifidium* var. *decipiens* CH, MH
*Trifolium cyathiferum* CH, MH
*Trifolium eriocephalum* var. *eriocephalum* MH, SS
*Trifolium fragiferum* (strawberry clover) SS
*Trifolium kingii* var. *productum* (Shasta clover) SS
*Trifolium macrocephalum* (large-headed clover) CH, MH, SS
*Trifolium pratense* MH, SS
*Trifolium repens* (white clover) CH, MH, SS
*Trifolium variegatum* phase 1 CH
*Vicia americana* var. *americana* (American vetch) CH, MH
*Vicia benghalensis* (purple vetch) CH, MH, SS

GENTIANACEAE
*Swertia albicaulis* var. nitida CH, MH

GERANIACEAE
*Erodium cicutarium* (filaree) CH, MH, SS

HYDROPHYLLACEAE
*Hydrophyllum capitatum* var. *alpinum* (woolen-breeches) MH
*Nemophila parviflora* var. *austinae* (water-leaf) CH, MH, SS
*Phacelia hastata* ssp. *hastata* (silverleaf phacelia) CH
*Phacelia heterophylla* ssp. *virgata* (varileaf phacelia) CH, MH
*Phacelia linearis* MH
*Phacelia racemosa* CH

HYPERICACEAE
*Hypericum anagalloides* (tinker's penny) CH, MH, SS
*Hypericum perforatum* (Klamath weed) CH, MH, SS

IRIDACEAE
*Iris missouriensis* (blue flag) CH, MH
*Sisyrinchium bellum* (blue-eyed grass) CH, SS
*Sisyrinchium douglasii* var. *douglasii* (grass widows) CH, MH, SS

LAMIACEAE
*Agastache urticifolia* (nettleleaf horsemint) CH, MH, SS
*Lamium purpureum* CH
*Marrubium vulgare* (horehound) CH, MH, SS
*Monardella odoratissima* ssp. *odoratissima* (coyote mint) CH, MH
*Monardella purpurea* (Siskiyou monardella) CH, MH
*Prunella vulgaris* var. *lanceolata* (self-heal, heal-all) CH, MH, SS
*Stachys ajugoides* var. *rigida* CH
*Trichostema lanceolatum* (vinegar weed) CH, MH, SS
*Trichostema oblongum* MH

LEMNACEAE
*Lemna minor* (duckweed) CH, MH

LILIACEAE
*Allium acuminatum* MH
*Allium amplectens* CH, MH
*Allium bolanderi* var. *bolanderi* (Bolander's onion) SS
*Allium membranaceum*? MH
*Allium peninsulare var. peninsulare* CH
*Allium siskiyouense* (siskiyou onion) CH, SS
*Allium tolmiei* var. *tolmiei* (Tolmie's onion) CH
*Brodiaea coronaria* ssp. *coronaria* (harvest brodiaea) CH, MH, SS
*Brodiaea elegans* ssp. ? (harvest brodiaea) MH
*Calochortus greenei* (Green's Mariposa lily) MH, SS
*Calochortus tolmiei* (Tolmie's cat ears) MH, SS
*Camassia quamash* ssp. *breviflora* (camas) CH, MH
*Dichelostemma capitatum* ssp. *capitatum* (blue dicks) MH, SS
*Dichelostemma congestum* (fork-tooth ookow) CH, MH, SS

*Dichelostemma multiflorum* (wild hyacinth) CH
*Fritillaria affinis* var. *affinis* (checker lily) CH, MH
*Fritillaria pudica* (yellow bells) SS
*Fritillaria recurva* (scarlet fritillary, red bells) MH, SS
*Lilium pardalinum* ssp. *vollmeri* (Vollmer's lily) MH
*Lilium washingtonianum* ssp *purpurascens* (Washington lily) CH, MH
*Smilacina racemosa* (false Solomon's seal) CH, MH, SS
*Smilacina stellata* (star Solomon's seal) CH, MH
*Streptopus amplexifolius* var. *americanus* (twisted stalk) CH
*Triteleia hyacinthina* (white brodiaea) CH, MH, SS
*Triteleia laxa* (Ithuriel's spear) CH
*Zigadenus paniculatus* (zigadene lily) CH, MH
*Zigadenus venenosus* var. *venenosus* (death camas) CH, MH, SS

LINACEAE
*Hesperolinon micranthum* (dwarf flax) CH

LOASACEAE
*Mentzelia dispersa* CH, MH, SS

MALVACEAE
*Malva neglecta* (cheeseweed) CH, MH, SS
*Sidalcea oregana* ssp. *oregana* (Oregon sidalcea) CH, MH, SS

ONAGRACEAE
*Clarkia gracilis* ssp. *gracilis* (slender clarkia) CH, MH
*Clarkia purpurea* ssp. *quadrivulnera* (four-spot) CH
*Clarkia rhomboidea* CH, MH
*Epilobium angustifolium* ssp. *circumvagum* (fireweed) MH
*Epilobium brachycarpum* (willowherb) CH, MH
*Epilobium ciliatum* ssp. *ciliatum* CH, MH
*Epilobium densiflorum* MH
*Epilobium saximontanum* MH
*Oenothera elata* ssp. *hirsutissima* (evening primrose) CH

ORCHIDACEAE
*Calypso bulbosa* (fairy slipper) SS
*Cephalanthera austiniae* (phantom orchid) CH
*Corallorhiza maculata* (spotted coralroot) CH
*Corallorhiza striata* (striped coralroot) CH
*Cypripedium montanum* (mountain lady's slipper) CH
*Piperia elegans* (crane orchid) CH
*Platanthera leucostachys* (white-flowered bog-orchid) CH, MH

OROBANCHACEAE
*Orobanche uniflora* (broom-rape) CH, MH, SS

PAEONIACEAE
*Paeonia brownii* (peony) CH, MH

PAPAVERACEAE
*Eschscholzia californica* (California poppy) CH, SS

PLANTAGINACEAE
*Plantago lanceolata* (English plantain) CH, MH, SS
*Plantago major* (broadleaf plantain) CH, SS

POLEMONIACEAE
*Collomia grandiflora* (large-flowered collomia) CH, MH, SS
*Gilia capitata* ssp. *capitata* (bluefield gilia) CH, MH, SS
*Ipomopsis aggregata* ssp. *formosissima* (scarlet gilia) CH, MH
*Linanthus bolanderi* MH, SS
*Navarretia divaricata* ssp. *vividior* (mountain navarretia) CH
*Navarretia intertexta* ssp. *propinqua* CH, MH
*Phlox gracilis* CH, MH
*Phlox speciosa* ssp. *occidentalis* (phlox) CH, MH

POLYGONACEAE
*Eriogonum compositum* var. *compositum* (wild buckwheat) MH
*Eriogonum elatum* var. *elatum* (wild buckwheat) CH
*Eriogonum nudum* var. *oblongifolium* (naked-stemmed eriogonum) CH, MH, SS
*Eriogonum umbellatum* var. ? (sulphur flower) CH, MH, SS
*Polygonum amphibium* var. *emersum* (kelp) SS
*Polygonum bistortoides* (bistort) CH, MH
*Polygonum californicum* (California smartweed) CH
*Polygonum douglasii* ssp. *majus* CH, MH, SS
*Polygonum punctatum* (water smartweed) MH, SS
*Rumex acetosella* (sheep sorrel) CH, MH, SS
*Rumex crispus* (curly dock) CH, MH, SS
*Rumex occidentalis* (western dock) MH, SS
*Rumex salicifolius* var. *denticulatus* (California dock) CH, MH
*Rumex salicifolius* var. *salicifolius* (willow-leaf dock) CH, MH, SS

PORTULACACEAE
*Claytonia exigua* ssp. *exigua* (springbeauty) MH
*Claytonia parviflora* ssp. *parviflora* (miner's lettuce) CH, MH
*Claytonia perfoliata* ssp. *perfoliata* (miner's lettuce) CH, MH
*Claytonia rubra* ssp. *rubra* (red claytonia) CH, MH
*Montia chamissoi* (toad lily) CH
*Montia linearis* CH, MH, SS

POTAMOGETONACEAE
*Potamogeton alpinus* ssp. *tenuifolius* (pondweed) CH, MH

PRIMULACEAE
*Dodecatheon pulchellum* (shooting star) CH, MH
*Trientalis latifolia* (western starflower) CH, MH

RANUNCULACEAE
*Actaea rubra* (western baneberry) CH
*Anemone deltoidea* (Columbia windflower) CH, MH
*Aquilegia formosa* (columbine) CH, MH

*Delphinium depauperatum* CH, MH
*Delphinium nuttallianum* (dwarf larkspur) CH, MH, SS
*Ranunculus aquatilus* var.*capillaceus* (water buttercup) MH
*Ranunculus arvensis* CH
*Ranunculus occidentalis* (western buttercup) CH, MH
*Ranunculus orthohynchus* var. *orthohynchus* (buttercup) MH

ROSACEAE
*Fragaria vesca* (wild strawberry) CH, MH
*Fragaria virginiana* (wild strawberry) CH, MH, SS
*Geum macrophyllum* (bigleaf avens) MH
*Geum triflorum* (old man's whiskers) CH
*Horkelia daucifolia* (carrot-leafed horkelia) MH
*Potentilla flabellifolia* (fanfoil) CH
*Potentilla glandulosa* ssp. *ashlandica* CH, MH
*Potentilla glandulosa* ssp. *glandulosa* (sticky cinquefoil) CH, MH, SS
*Potentilla gracilis* var. *gracilis* (slender cinquefoil) CH, MH, SS
*Potentilla millefolia* MH, SS
*Sanguisorba minor* ssp. *muricata* (garden burnet) MH
*Sanguisorba occidentalis* (western burnet) CH, MH, SS

RUBIACEAE
*Galium aparine* (catchweed bedstraw) CH, MH, SS
*Galium bolanderi* (Bolander's bedstraw) MH
*Galium boreale* ssp. *septentrionale* (northern bedstraw) CH

SAXIFRAGACEAE
*Lithophragma heterophyllum* (woodland star) CH
*Lithophragma parviflorum* var. *parviflorum* (woodland star) CH, MH, SS
*Saxifraga integrifolia* (saxifrage, woodland star) CH, MH
*Saxifraga oregana* (saxifrage) MH
*Tellima grandiflora* (fringe cups) SS

SCROPHULARIACEAE
*Castilleja affinis* ssp. *affinis* (paintbrush) CH
*Castilleja applegatei* ssp. *pinetorum* (Applegate's paintbrush) CH, MH
*Castilleja lacera* (paintbrush) CH
*Castilleja miniata* ssp. *miniata* (giant red paintbrush) CH, MH
*Castilleja pruinosa* CH, SS
*Castilleja tenuis* (paintbrush) CH, SS
*Collinsia parviflora* MH, SS
*Collinsia rattanii* MH
*Linaria vulgaris* (butter and eggs, toad flax) CH
*Mimulus guttatus* var. *guttatus* (yellow monkeyflower) CH, MH, SS
*Mimulus primuloides* ssp. *primuloides* (primrose monkeyflower) MH
*Orthocarpus bracteosus* (purple owl's clover) CH, MH
*Orthocarpus imbricatus* (imbricated owl's clover) CH, MH, SS
*Orthocarpus luteus* (yellow owl's clover) CH, MH
*Pedicularis densiflora* (Indian warrior) CH, MH, SS
*Penstemon deustus* var. *pedicellatus* (hot rock penstemon) CH, MH, SS
*Penstemon heterophyllus* var. *purdyi* CH
*Penstemon humilis* var. *humilis* CH, MH, SS

*Penstemon parvulus* MH, SS
*Penstemon roezlii* CH
*Penstemon rydbergii* var. *oreocharis* CH
*Tonella tenella* MH
*Verbascum blattaria* (moth mullein) CH, MH, SS
*Verbascum thapsus* (flannel mullein) CH, MH, SS
*Veronica anagallis-aquatica* (water speedwell) CH, MH
*Veronica arvensis* (veronica, speedwell) CH, MH, SS
*Veronica catenata* (chain speedwell) MH
*Veronica peregrina* ssp. *xalapensis* (purslane speedwell) CH, MH

SOLANACEAE
*Nicotiana attenuata* (coyote tobacco) CH, SS
*Solanum dulcamara* (bittersweet nightshade) CH

URTICACEAE
*Urtica dioica* ssp. *holosericea* (stinging nettle) CH, MH, SS

VALERIANACEAE
*Plectritis brachystemon* CH
*Plectritis congesta* (short-spurred plectritis, sea-blush) CH, MH
*Plectritis macrocera* SS

VIOLACEAE
*Viola adunca* MH
*Viola bakeri* CH, MH, SS
*Viola purpurea* ssp. *purpurea* (mountain violet) CH
*Viola sororia* ssp. *affinis* (leonte violet) SS

VISCACEAE
*Phoradendron densum* (dense mistletoe) CH, MH, SS
*Phoradendron juniperinum* (juniper mistletoe) IG
*Phoradendron villosum* (oak mistletoe) CH, IG, SS

ZYGOPHYLLACEAE
*Tribulus terrestris* (puncture vine) SS

**GRASSES AND GRASS-LIKE PLANTS**

CYPERACEAE
*Carex dudleyi* (sedge) CH
*Cyperus squarrosus* CH
*Eleocharis acicularis* (spikerush) CH
*Scirpus acutus* var. *occidentalis* (hardstem bulrush, tule) CH, SS
*Scirpus microcarpus* (tule) CH, MH, SS
*Scirpus pungens* (three-square bulrush) SS

JUNCACEAE
*Juncus effusus* var. *pacificus* CH
*Juncus* sp. (rush) SS

POACEAE
*Avena barbata* (wild oats) CH, MH
*Bromus carinatus* var.? (California brome) CH
*Bromus hordaeceus* SS
*Bromus madritensis* ssp. *rubens* (foxtail chess, red brome) CH, MH, SS
*Bromus tectorum* (cheatgrass) CH, MH, SS
*Cynosurus echinatus* (hedgehog dogtail) CH, MH, SS
*Elymus elymoides* ssp. *elymoides* (squirrel-tail) CH, MH, SS
*Elymus glaucus* ssp. *glaucus* (blue wild rye) MH, SS
*Festuca idahoensis* (Idaho fescue) MH, SS
*Hordeum depressum* (low barley) SS
*Hordeum* sp. (fox-tail barley) CH, SS
*Koeleria macrantha* (junegrass) CH, MH, SS
*Phalaris arundinacea* (canary reed grass) CH, MH, SS
*Phleum pratense* (timothy) CH, MH, SS
*Phragmites australis* (common reed) CH
*Poa bulbosa* (Hoover grass, bulbous bluegrass) CH, MH, SS
*Polypogon monspeliensis* (annual beard grass) SS
*Taeniatherum caput-medusae* (medusa-head wild rye) MH

TYPHACEAE
*Sparganium* sp. (bur-reed) CH, MH
*Typha latifolia* (cattail) CH, SS

**FERNS**

DENNSTAEDTIACEAE
*Pteridum aquillinum* var. *pubescens* (bracken fern) CH, MH

DRYOPTERIDACEAE
*Athyrium filix-femina* var. *cyclosorum* (lady fern) CH
*Cystopteris fragilis* (brittle bladder fern) CH, MH
*Polystichum imbricans* ssp. *imbricans* (imbricated sword fern) CH

PTERIDACEAE
*Cryptogramma acrostichoides* (American parsley fern) CH

**HORSETAILS**

EQUISETACEAE
*Equisetum arvense* (horsetail) CH, SS
*Equisetum hyemale* ssp. *affine* (smooth scouring rush) CH, MH

**LICHENS**

*Bryoria fremontii* (black hanging lichen) CH, MH, SS
*Hypogymnia imshaughii* CH
*Letharia vulpina* (wolf moss) CH, MH, SS
*Usnea lapponica* (white hanging lichen) MH

**Key**

| | | |
|---|---|---|
| CH | = | Chicken Hills Quadrangle |
| MH | = | Mule Hill Quadrangle |
| SS | = | Secret Springs Mountain Quadrangle |
| x | = | Plant Map Location supported by a Herbarium Sample (within the author's possession) |

Vascular Plant Names derived from and updated by The Jepson Manual, 1993
Moss and Lichen Names derived from Mosses, Lichens & Ferns of Northwest North America, 1988

Compilation Notes: Plant Locations are primarily derived from occurrences in plant lists compiled in 1998, 1999, and 2000 during ethnobotanical surveys conducted by Susan M. Gleason. Other sources of information include - plant samples within the collections possessed by the author; plants mentioned in notes taken by the author while doing archaeological and other work in the area between 1992-2000; plants reported in the 1993 and 1997 notes of Donn Todt; and locations noted within the California Native Plant Society's 1994 publication of its Inventory of Rare and Endangered Plants

Cautionary Note: Many plants have a acknowledged wider distribution than that which is reported by this list, but until a confirmed map point is recorded that larger distribution will not be reflected herein. Furthermore, the map occurrence frequency of a plant should not be taken as a reflection of the abundance of such a plant within any single quadrangle map area. Additionally, several plants are known to be in the area covered within this list but have yet to be confirmed by a specific reference to a location within the mapped area.

Revised June 20, 2002

**Susan M. Gleason, UCR**

# Appendix K – Wildlife Species List

**Priority Species Within the Upper Klamath River Management Area**

| Species | Federal Status | BLM Status | Other Status |
|---|---|---|---|
| Bat, Townsend's big eared | None | Bureau Tracking | State Sensitive |
| Deer, Black- tailed | None | | Social status |
| Deer, Mule | None | | Social status |
| Eagle, Bald | Threatened | | |
| Elk | None | | Social status |
| Goshawk, Northern | None | Bureau Sensitive | State Sensitive |
| Nuthatch, Pygmy | None | Bureau Tracking | State Sensitive<br>Protection Buffer |
| Owl, Flammulated | None | Bureau Sensitive | Protection Buffer |
| Owl, Great Gray | None | Bureau Tracking | Protection Buffer |
| Owl, Northern Spotted | Threatened | Bureau Sensitive | |
| Woodpecker, White-headed | None | Bureau Sensitive | State Sensitive<br>Protection Buffer |

**List and status of the amphibians, reptiles, birds, and mammals documented to occur, or with the potential to occur, within the Upper Klamath River Management Area.**

| | | STATUS | | | |
|---|---|---|---|---|---|
| **Common Name** | ***Scientific Name*** | **FWS** | **BLM** | **OR** | **CA** |
| **AMPHIBIANS** | | | | | |
| Ensatina | *Ensatina eschscholtzii* | | | | |
| Frog, Bull | *Rana catesbeiana* | | | | |
| Frog, Foothill Yellow-legged | *Rana boylii* | | BA | V | CSC |
| Frog, Oregon Spotted | *Rana pretiosa* | | BA | C | CSC |
| Frog, Pacific Chorus * | *Hyla regilla* | | | | |
| Frog, Tailed | *Ascaphus truei* | | BT | V | CSC |
| Newt, Rough-skinned | *Taricha granulosa* | | | | |
| Salamander, Long-toed | *Ambystoma macrodactylum* | | | | |
| Salamander, Pacific Giant | *Dicamptodon tenebrosus* | | | | |
| Spadefoot, Great Basin | *Scaphiopus intermontanus* | | | | |
| Toad, Western * | *Bufo boreas* | | BT | V | |

| **REPTILES** | | **FWS** | **BLM** | **OR** | **CA** |
|---|---|---|---|---|---|
| Boa, Rubber * | *Charina bottae* | | | | |
| Garter Snake, Common * | *Thamnophis siralis* | | | | |
| Garter Snake, Klamath | *Thamnophis elegans biscutatus* | | | | |
| Garter Snake, Northwestern | *Thamnophis ordinoides* | | | | |
| Garter Snake, Western Aquatic | *Thamnophis couchii* | | | | |
| Garter Snake, Western Terrestrial* | *Thamnophis elegans* | | | | |
| Kingsnake, Common * | *Hypsiglena torquata* | | BT | V | |
| Kingsnake, California Mountain* | *Lampropeltis zonata* | | BT | V | |
| Lizard, Northern Alligator | *Elgaria coerulea* | | | | |
| Lizard, Northern Sagebrush * | *Sceloporus graciosus graciosus* | | BT | | |
| Lizard, Short-horned | *Phrynosoma douglassii* | | | | |
| Lizard, Southern Alligator * | *Elgaria multicarinata* | | | | |
| Lizard, Western Fence * | *Sceloporus occidentalis* | | | | |
| Pond Turtle, North-Western * | *Clemmys marmorata marmorata* | | BT | C | CSC |
| Racer, Western Yellow-bellied * | *Coluber constrictor morman* | | | | |
| Rattlesnake, Western * | *Crotalis viridis* | | | | |
| Skink, Western * | *Eumeces skiltonianus* | | | | |
| Slider, Red-eared | *Pseudemys scripta elegans* | | | | |
| Snake, Gopher * | *Pituophis catenifer* | | | | |
| Snake, Night | *Hypsiglena torquata* | | | | |
| Snake, Ringneck * | *Diadophispunctatus* | | | | |
| Snake, Sharptail * | *Contia tenuis* | | BT | V | |
| Whipsnake, Striped * | *Masticophis taeniatus* | | | | |

| **FURBEARERS** | | **FWS** | **BLM** | **OR** | **CA** |
|---|---|---|---|---|---|
| Badger, American | *Taxidea taxus* | | | | |
| Beaver, American * | *Castor canadensis* | | | | |
| Bobcat * | *Lynx rufus* | | | | |
| Coyote * | *Canis latrans* | | | | |
| Ermine | *Mustela erminea* | | | | |
| Fisher | *Martes pennanti* | | BT | C | CSC |

| **FURBEARERS (continued)** | | **FWS** | **BLM** | **OR** | **CA** |
|---|---|---|---|---|---|
| Fox, Common Gray * | *Urocyon cinereoargenteus* | | | | |
| Fox, Red | *Vulpes vulpes* | | | | |
| Marten, American | *Martes americana* | | BT | V | |
| Mink * | *Mustela vison* | | | | |
| Muskrat * | *Ondatra zibethica* | | | | |
| Otter, River * | *Lutra canadensis* | | | | |
| Raccoon * | *Procyon lotor* | | | | |
| Ringtail * | *Bassariscus astutus* | | BT | U | |
| Weasel, Long-tailed | *Mustela frenata* | | | | |

| **BATS** | | **FWS** | **BLM** | **OR** | **CA** |
|---|---|---|---|---|---|
| Bat, Big Brown * | *Eptesicus fuscus* | | | | |
| Bat, Hoary | *Lasiurus cinereus* | | | | |
| Bat, Pallid | *Antrozous pallidus* | | BT | V | CSC |
| Bat, Silver-haired | *Lasionycteris noctivagans* | | BTO | U | |
| Bat, Townsend's Big-eared * | *Corynothinus townsendii* | | BT | C | CSC |
| Myotis, California * | *Myotis californicus* | | | | |
| Myotis, Fringed | *Myotis thysanodes* | | BT | V | |
| Myotis, Little Brown * | *Myotis lucifugus* | | | | |
| Myotis, Long-eared | *Myotis evotis* | | BT | U | |
| Myotis, Long-legged | *Myotis volans* | | BT | U | |
| Myotis, Western small-footed | *Myotis ciliolabrumaka* | | BT | U | |
| Myotis, Yuma * | *Myotis yumanensis* | | BTO | | |

| **BIG GAME** | | **FWS** | **BLM** | **OR** | **CA** |
|---|---|---|---|---|---|
| Bear, Black * | *Ursus americanus* | | | | X |
| Boar, Wild * | *Sus scrofa* | | | X | X |
| Deer, Black-tailed * | *Odocoileus hermionus columbianus* | | | X | |
| Deer, Mule * | *Odocoileus hermionus hermionus* | | | | X |
| Elk * | *Cervus elaphus* | | | X | X |
| Mountain Lion * | *Felis concolor* | | | X | X |

| SMALL ANIMALS | | FWS | BLM | OR | CA |
|---|---|---|---|---|---|
| Chipmunk, Least | *Tamias minimus* | | | | |
| Chipmunk, Yellow-pine | *Tamias amoenus* | | | | |
| Cottontail, Mountain | *Sylviagus nuttallii* | | | | |
| Gopher, Botta's Pocket | *Thomoys bottae* | | | | |
| Gopher, Western Pocket | *Thomoys mazama* | | | | |
| Hare, Snowshoe | *Lepus americanus* | | | | |
| Marmot, Yellow-bellied | *Marmota flaviventris* | | | | |
| Mole, Broad-footed | *Scapanus latimous* | | | | |
| Mole, Shrew | *Neurotrichus gibbsii* | | | | |
| Mouse, Deer | *Peromyscus maniculatus* | | | | |
| Mouse, Pacific Jumping | *Zapus trinotatus* | | | | |
| Mouse, Western Harvest | *Reithrodontomys meqalotis* | | | | |
| Mouse, Western Jumping | *Zapus princeps* | | | | |
| Pika, American | *Ochotona princeps* | | | | |
| Porcupine, Common | *Erethizon dorsatum* | | | | |
| Jack Rabbit, Black-tailed | *Lepus californicus* | | | | |
| Shrew, Dusky | *Sorex obscurus* | | | | |
| Shrew, Marsh | *Sorex bendirii* | | | | |
| Shrew, Trowbridge | *Sorex trowbridgii* | | | | |
| Shrew, Vagrant | *Sorex vagrans* | | | | |
| Shrew, Water | *Sorex palustris* | | | | |
| Skunk, Striped | *Mephitis mephitis* | | | | |
| Skunk, Western Spotted | *Spilogale qnaeilis* | | | | |
| Squirrel, Belding's Ground | *Spermophilus beldingi* | | | | |
| Squirrel, California Ground | *Spermophilus beecheyi* | | | | |
| Squirrel, Golden-mantled Ground | *Spermophilus lateralis* | | | | |
| Squirrel, Douglas | *Tamiasciurus douglasii* | | | | |
| Squirrel, Northern Flying | *Glaucomys sabrinus* | | | | |
| Squirrel, Western gray | *Sciurus griseus* | | | | |
| Vole, Heather | *Phenacomys intermedius* | | | | |
| Vole, Long-tailed | *Microtus longicaudus* | | | | |
| Vole, Montane | *Microtis montanus* | | | | |
| Vole, Western Red-backed | *Clethrionomys californicus* | | | | |
| Woodrat, Bushy-tailed | *Neotoma cinera* | | | | |
| Woodrat, Dusky-footed | *Neotoma fuscipes* | | | | |

| **BIRDS OF PREY** | | **FWS** | **BLM** | **OR** | **CA** |
|---|---|---|---|---|---|
| Eagle, Bald * | *Haliaeetus leucocephalus* | FT | | ST | SE |
| Eagle, Golden * | *Aquila chrysaetos* | | | | FP |
| Falcon, Peregrine * | *Falco peregrinus* | | BS | SE | SE |
| Falcon, Prairie * | *Falco mexicanus* | | | | CSC |
| Goshawk, Northern * | *Accipiter gentilis* | | BS | C | CSC |
| Hawk, Sharp-shinned * | *Accipiter striatus* | | | | CSC |
| Hawk, Cooper's * | *Accipiter cooperii* | | | | CSC |
| Hawk, Red-tailed * | *Buteo jamaicensis* | | | | |
| Kestrel, American * | *Falco sparverius* | | | | |
| Merlin * | *Falco columbaris* | | BA | | CSC |
| Osprey * | *Pandion haliaetus* | | | | CSC |
| Owl, Flammulated * | *Otus flammeolus* | | BS | C | |
| Owl, Great Gray | *Strix nebulosa* | | BT | V | SE |
| Owl, Great Horned * | *Bubo virginianus* | | | | |
| Owl, Long-eared * | *Asio otus* | | | | |
| Owl, Northern Pygmy * | *Glaucidium gnoma* | | | | |
| Owl, Northern Saw-whet * | *Aegolius acadicus* | | | | |
| Owl, Northern Spotted | *Strix occidentalis caurina* | FT | | ST | |
| Owl, Western Screech * | *Otus kennicottii* | | | | |

| **GAME BIRDS** | | **FWS** | **BLM** | **OR** | **CA** |
|---|---|---|---|---|---|
| Dove, Mourning * | *Zenaida macroura* | | | | |
| Grouse, Blue * | *Dendragapus obscurus* | | | | |
| Grouse, Ruffed | *Bonasa umbellus* | | | | |
| Quail, California * | *Callipepla californica* | | | | |
| Quail, Mountain * | *Oreortyz pictus* | | BT | U | |
| Turkey, Wild * | *Meleagris gallopavo* | | | | |

| **WOODPECKERS** | | **FWS** | **BLM** | **OR** | **CA** |
|---|---|---|---|---|---|
| Flicker, Northern * | *Colaptes auratus* | | | | |
| Sapsucker, Red-breasted * | *Sphyrapicus rubber* | | | | |
| Sapsucker, Red-naped | *Sphyrapicus nuchalis* | | | | |
| Sapsucker, Williamson's | *Sphyrapicus thyroideus* | | BT | U | |
| Woodpecker, Acorn * | *Melanerpes formicivorus* | | BT | | |

| WOODPECKERS (continued) | | FWS | BLM | OR | CA |
|---|---|---|---|---|---|
| Woodpecker, Black-backed | *Picoides arcticus* | BS | BS | C | |
| Woodpecker, Downy * | *Picoides pubescens* | | | | |
| Woodpecker, Hairy * | *Picoides villosus* | | | | |
| Woodpecker, Lewis'* | *Melanerpes lewis* | | BS | C | |
| Woodpecker, Pileated * | *Dryocopus pileatus* | | BT | V | |
| Woodpecker, Three-toed | *Picoides tridactylus* | | BS | C | |
| Woodpecker, White-headed * | *Picoides albolarvatus* | | BS | C | |

| WATER ASSOCIATED BIRDS | | FWS | BLM | OR | CA |
|---|---|---|---|---|---|
| Bufflehead * | *Bucephala albeala* | | BA | U | |
| Coot, American | *Fulica americana* | | | | |
| Cormorant, Double-crested * | *Phalacrocorax auritus* | | | | |
| Duck, Harlequin | *Histrionicus histronicus* | | | | |
| Duck, Ring-necked | *Aythyra collaris* | | | | |
| Duck, Ruddy | *Oxyura jamaicensis* | | | | |
| Duck, Wood* | *Aix sponsa* | | | | |
| Egret, Great * | *Casmerodius albus* | | BT | | |
| Egret, Snowy | *Egretta thula* | | BA | V | |
| Gadwall | *Anas strepera* | | | | |
| Goldeneye, Barrow's | *Bucephala islandica* | | BT | U | CSC |
| Goldeneye, Common | *Bucephala clangula* | | | | |
| Goose, Canada * | *Branta canadensis* | | | | |
| Goose, Ross' | *Chen rossii* | | | | |
| Goose, Snow | *Chen caerulescens* | | | | |
| Goose, White-fronted | *Anser albitrons* | | | | |
| Grebe, Clark's | *Aechmophprus clarkii* | | | | |
| Grebe, Eared | *Podiceps nigricollis* | | | | |
| Grebe, Horned | *Podiceps auritus* | | BT | P | |
| Grebe, Pied-billed | *Podilymbus podiceps* | | | | |
| Grebe, Western | *Aechmophorus occidentalis* | | | | |
| Gull, Bonaparte's | *Larus philidelphia* | | | | |
| Gull, California * | *Larus californicus* | | | | CSC |
| Gull, Ring-billed* | *Larus californicus* | | | | |

| **WATER ASSOCIATED BIRDS (continued)** | | **FWS** | **BLM** | **OR** | **CA** |
|---|---|---|---|---|---|
| Heron, Black-crowned Night * | *Nycticorax nycticorax* | | | | |
| Heron, Great Blue * | *Ardea herodias* | | | | |
| Heron, Green-backed | *Butorides striatus* | | | | |
| Killdeer | *Charadrius vociferous* | | | | |
| Merganser, Common * | *Mergus merganser* | | | | |
| Merganser, Hooded | *Lophodytes cucullatus* | | | | |
| Mallard * | *Anas paltyrhynchos* | | | | |
| Pelican, American White* | *Pelecanus erythrorhynchos* | | BA | V | CSC |
| Pintail, Northern | *Anas acuta* | | | | |
| Redhead | *Aythyra americana* | | | | |
| Sandpiper, Spotted * | *Actitis macularia* | | | | |
| Shoveler, Northern | *Anas clypeata* | | | | |
| Snipe, Common | *Galinago gallingo* | | | | |
| Teal, Green-winged | *Anas crecca* | | | | |
| Teal, Blue-winged | *Anas discors* | | | | |
| Teal, Cinnamon | *Anas cyahoptera* | | | | |
| Tern, Black | *Chlidonias niger* | | BT | | CSC |
| Tern, Caspian | *Sterna caspia* | | | | |
| Tern, Forster's | *Sterna forsteri* | | BT | | |
| Wigeon, American | *Anas americana* | | | | |

| **LAND BIRDS** | | **FWS** | **BLM** | **OR** | **CA** |
|---|---|---|---|---|---|
| Blackbird, Brewer's * | *Euphagus cyanocephalus* | | | | |
| Blackbird, Red-winged * | *Agelaius phoeniceus* | | | | |
| Blackbird, Tricolored | *Agelaius tricolor* | | BA | P | CSC |
| Blackbird, Yellow-headed | *Xanthocephalus xanthocephalus* | | | | |
| Bluebird, Mountain * | *Sialia currucoides* | | | | |
| Bluebird, Western * | *Sialia mexicana* | | | | |
| Bunting, Lazuli * | *Passerina amoena* | | | | |
| Bushtit * | *Pasltriparus minimus* | | | | |
| Chat, Yellow-breasted * | *Icteria virens* | | | | CSC |
| Chickadee, Black-capped * | *Parus articapillus* | | | | CSC |
| Chickadee, Chestnut-backed | *Parus rufescens* | | | | |
| Chickadee, Mountain * | *Parus gambeli* | | | | |

| LAND BIRDS (continued) | | FWS | BLM | OR | CA |
|---|---|---|---|---|---|
| Cowbird, Brown-headed * | *Molothrus ater* | | | | |
| Creeper, Brown * | *Certhia Americana* | | | | |
| Crossbill, Red * | *Loxia curvirostra* | | | | |
| Dipper, American * | *Cinclus mexicanus* | | | | |
| Finch, Cassin's * | *Carpodacus cassinii* | | | | |
| Finch, House * | *Carpodacus mexicanus* | | | | |
| Finch, Purple * | *Carpodacus cassinii* | | | | |
| Flicker, Northern * | *Colaptes auratus* | | | | |
| Flycatcher, Ash-throated | *Myiarchus cinerascens* | | | | |
| Flycatcher, Cordilleran | *Empidonax occidentalis* | | | | |
| Flycatcher, Dusky * | *Empidonax oberholseri* | | | | |
| Flycatcher, Gray * | *Empidonax wrightii* | | | | |
| Flycatcher, Hammond's | *Empidonax hammondii* | | | | |
| Flycatcher, Olive-sided * | *Contopus borealis* | | BT | V | |
| Flycatcher, Pacific-slope | *Empidonax difficilis* | | | | |
| Flycatcher, Willow * | *Empidonax trailii* | | BT | U | SE |
| Gnatcatcher, Blue-gray | *Polioptila caerulea* | | BT | | |
| Goldfinch, American * | *Carduelis tristis* | | | | |
| Goldfinch, Lesser * | *Carduelis psaltria* | | | | |
| Grosbeak, Black-headed * | *Phucticus lelanocephalus* | | | | |
| Grosbeak, Evening | *Coccothraustes vespertinus* | | | | |
| Grosbeak, Rose-breasted * | *Pheucticus ludovicianus* | | | | |
| Hummingbird, Allen's * | *Selasphorus sasin* | | BT | | |
| Hummingbird, Anna's | *Calypte anna* | | | | |
| Hummingbird, Black-chinned | *Archilochus alexandri* | | | | |
| Hummingbird, Calliope * | *Stellula calliope* | | | | |
| Hummingbird, Rufus | *Selasphorus rufus* | | | | |
| Junco, Dark-eyed * | *Junco hyemalis* | | | | |
| Kinglet, Golden-crowned * | *Regulus satrapa* | | | | |
| Kinglet, Ruby-crowned * | *Regulus calendula* | | | | |
| Kingbird, Western | *Tyrannus verticalis* | | | | |
| Kingfisher, Belted * | *Ceryle alcyon* | | | | |
| Martin, Purple | *Progne subis* | | BS | C | CSC |
| Meadowlark, Western * | *Sturnella neglecta* | | | | |
| Nighthawk, Common * | *Chordeiles minor* | | | | |
| Nuthatch, Pygmy * | *Sitta pygmaea* | | BT | V | |
| Nuthatch, Red-breasted * | *Sitta Canadensis* | | | | |
| Nuthatch, White-breasted * | *Sitta carolinersis* | | | | |

| **LAND BIRDS (continued)** | | **FWS** | **BLM** | **OR** | **CA** |
|---|---|---|---|---|---|
| Oriole, Bullock's * | *Icterus bullockii* | | | | |
| Pipit, American | *Anthus rubescens* | | | | |
| Phoebe, Say's | *Sayornis saya* | | | | |
| Poorwill, Common | *Phalaenopitlus nuttallii* | | | | |
| Redstart, American * | *Setophaga ruticilla* | | | | |
| Robin, American * | *Turdus migratorius* | | | | |
| Siskin, Pine * | *Carduelis pinus* | | | | |
| Solitaire, Townsend's * | *Myadestes townsendi* | | | | |
| Sparrow, Brewer's | *Sipzella breweri* | | | | |
| Sparrow, Chipping* | *Spizella passerina* | | | | |
| Sparrow, Fox * | *Passerella iliaca* | | | | |
| Sparrow, Gambell's White-crowned * | *Zonotrichia leucophrys* | | | | |
| Sparrow, Golden-crowned | *Zonotrichia atricapilla* | | | | |
| Sparrow, House * | *Passer domesticus* | | | | |
| Sparrow, Lincoln's * | *Melospiza lincolnii* | | | | |
| Sparrow, Puget Sound White-crowned* | *Zonotrichia leucophrys* | | | | |
| Sparrow, Savannah * | *Passerculus sandwichensis* | | | | |
| Sparrow, Song * | *Melospiza melodia* | | | | |
| Sparrow, Vesper | *Pooecetes graminues* | | | | |
| Starling, European | *Sturnus vulgaris* | | | | |
| Swallow, Bank * | *Riparia riparia* | | BT | U | ST |
| Swallow Barn, | *Hirundo rustica* | | | | |
| Swallow, Cliff | *Hirundo pyrrchonota* | | | | |
| Swallow, N. Rough-winged * | *Stelgidopteryx serripennis* | | | | |
| Swallow, Tree * | *Tachycineta bicolor* | | | | |
| Swallow, Violet-green * | *Tachycineta thalassina* | | | | |
| Swift, Vaux's * | *Aeronautes saxatails* | | | | CSC |
| Tanager, Western * | *Piranga ludoviciana* | | | | |
| Titmouse, Juniper * | *Baeolophus ridgwayi* | | | | |
| Titmouse, Oak * | *Bueolophus inornatus* | | | | |
| Thrush, Hermit * | *Catharus guttatus* | | | | |
| Thrush, Swainson's | *Catharus ustulatus* | | | | |
| Thrush, Varied * | *Ixoreus naevius* | | | | |
| Towhee, California | *Pipilo crissalis* | | | | |
| Towhee, Green-tailed * | *Piplo chlorurus* | | | | |
| Towhee, Spotted * | *Pipilo maculates* | | | | |
| Vireo, Cassin's * | *Vireo cassinii* | | | | |

| LAND BIRDS (continued) | | FWS | BLM | OR | CA |
|---|---|---|---|---|---|
| Vireo, Red-eyed * | *Vireo olivaceus* | | | | |
| Vireo, Warbling * | *Vireo gilvus* | | | | |
| Warbler, Black-throated Gray * | *Dendroica nigrescens* | | | | |
| Warbler, Hermit | *Dendroica occidentalis* | | | | |
| Warbler, MacGillivray's * | *Opororni xolmieis* | | | | |
| Warbler, Nashville * | *Vermivora ruficapilla* | | | | |
| Warbler, Orange-crowned * | *Vermivora celata* | | | | |
| Warbler, Townsend's | *Dendroica townsendii* | | | | |
| Warbler, Wilson's * | *Wilsoni pusillaa* | | | | |
| Warbler, Yellow-rumped * | *Dendroica coronata* | | | | |
| Warbler, Yellow * | *Dendroica pexechia* | | | | CSC |
| Waxwing, Bohemian * | *Bombycilla garrulous* | | | | |
| Waxwing, Cedar * | *Bombycilla cedrorum* | | | | |
| Wood-peewee, Western * | *Contopus sordidulus* | | | | |
| Wren, Bewick's | *Thryomanes bewickii* | | | | |
| Wren, Canyon * | *Catherpes mexicanus* | | | | |
| Wren, House * | *Troglodytes aedon* | | | | |
| Wren, Marsh * | *Cistothorus mexicanus* | | | | |
| Wren, Rock | *Salpinctes obsoletus* | | | | |
| Wren, Winter * | *Troglodytes troglodytes* | | | | |
| Wrentit * | *Chamaea fasciata* | | | | |
| Yellowthroat, Common * | *Geothlypis trichas* | | | | |

| OTHER BIRDS | | FWS | BLM | OR | CA |
|---|---|---|---|---|---|
| Crow, American * | *Corvus brachyrhynchos* | | | | |
| Jay, Steller's * | *Cyanocitta stelleri* | | | | |
| Jay, Western Scrub * | *Aphelocoma californica* | | | | |
| Magpie, Black-billed * | *Pica pica* | | | | |
| Nutcraker, Clark's * | *Nucifraga columbiana* | | | | |
| Raven, Common * | *Corvus corax* | | | | |
| Vulture, Turkey * | *Cathartes aura* | | | | |

**Appendix K - Wildlife Species List**

**Table Codes**

***** Documented Occurrence

Abbreviations used in **FWS** (U.S. Fish and Wildlife Service):
FE: Listed as endangered by U.S. Fish and Wildlife Service
FT: Listed as threatened by the U.S. Fish and Wildlife Service

Abbreviations used in **BLM** (Bureau of Land Management):
BA(O): BLM Assessment in Oregon
BT(O): Bureau Tracking Oregon
BS: Bureau Sensitive

Abbreviations used in **OR** (Oregon State):
SE: State Endangered
ST: State Threatened
C: Critical
V: Vulnerable
P: Peripheral/Naturally Rare
U: Undetermined Status

Abbreviations used in **CA** (California State):
CSC: Species of Special Concern
SE: State Endangered
ST: State Threatened
FP: Fully Protected

# Appendix L – Aquatic Conservation Strategy Evaluation

The Aquatic Conservation Strategy (ACS) was developed (as part of the Northwest Forest Plan) to restore and maintain the ecological health of watersheds and aquatic ecosystems contained within them on public lands. The ACS is designed to meet the following objectives:

- Maintain and restore the distribution, diversity and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations and communities are uniquely adapted.

- Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life history requirements of aquatic and riparian-dependent species.

- Maintain and restore the physical integrity of the aquatic system, including shorelines, banks and bottom configurations.

- Maintain and restore water quality necessary to support healthy riparian, aquatic and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical and chemical integrity of the system and benefits survival, growth, reproduction and migration of individuals composing aquatic and riparian communities.

- Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate and character of sediment input, storage and transport.

- Maintain and restore in-streamflows sufficient to create and sustain riparian, aquatic and wetland habitats and to retain patterns of sediment, nutrient and wood routing. The timing, magnitude, duration and spatial distribution of peak, high and low flows must be protected.

- Maintain and restore the timing, variability and duration of floodplain inundation and water table elevation in meadows and wetlands.

- Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion and channel migration and to supply amounts and distributions of coarse woody debris sufficient to sustain physical complexity and stability.

- Maintain and restore habitat to support well-distributed populations of native plant, invertebrate and vertebrate riparian-dependent species.

This appendix will provide detailed information regarding the type, location, and intensity of proposed management actions near watercourses, and will identify the cumulative effects of these actions on the functionality of the riparian reserve system within the planning area.

Additionally, this appendix will summarize the effects of each alternative on the nine ACS objectives. This evaluation will be based on actions proposed across the entire planning area.

## Riparian Reserves

Riparian reserves apply on to federal land. In order to assess the relative effects of proposed actions on federal land and recommended actions on non-federal land, “riparian corridors” were delineated for non-federal lands within the planning area.

## Assumptions

Because of the proximity of hydrologic features to one another in some areas, numerous types of riparian reserves overlap. In these situations, effects were discussed only for one type of reserve, in order to avoid "double counting" of effects. Reserve types were prioritized as follows: fish-bearing streams, non-fish-bearing streams, wetlands greater than one acre, wetlands less than one acre, and reservoirs. For example, a vegetation treatment proposed within the reserve of both a fish-bearing stream and a wetland less than one acre would be documented as an effect to the stream.

The overall extent of riparian reserves and riparian corridors in the planning area may be overestimated in this analysis. The extent and seasonality of every intermittent and ephemeral stream has not been ground-truthed. In order to maintain a "margin of safety" in this analysis, non-perennial streams were assumed to be intermittent (though some are likely ephemeral), and thus received a 140-foot buffer (equivalent to the height of one site potential tree). The reserves associated with fish-bearing streams and wetlands are mapped accurately.

The shape of riparian reserves often takes a linear form, following the transition from riverine and riparian environments to upland features. Proposed actions within reserves can be considered as points (such as campsites), lines (such as roads and trails), and polygons (such as vegetation treatment units). Linear and polygon features would have the most influence on the function of riparian reserves, since they would impact larger portions of the reserve system. Despite their relatively small areal extent, linear features would have a disproportionate impact on functions such as connectivity and CWD recruitment. Point features would not be expected to have large overall effects, but could affect local features, and in some cases could cause effects that perpetuate downstream.

## Common to all Alternatives

Best Management Practices and guidance from the KFRA ROD/RMP will be implemented when delineating riparian reserves.

**Scenery Management –** Proposed vegetation planting at campgrounds, river access points, and in the vicinity of PacifiCorp facilities would add minor habitat value to developed sites that are within riparian reserves.

**Recreation Management –** Most recreation sites in the planning area occur within the riparian reserves of the river. With regards to the impacts of recreation resource management on riparian reserves, management actions can be categorized as one of the following:

- Existing site management - Management of existing sites would continue, except at those sites discussed below under a specific alternative. Use levels and types of use would not be expected to change at existing sites. Hazard trees near developed campsites would be felled.

- Site development - Site development includes the construction of new recreation sites or facilities. In the planning area, this includes boat launches, dispersed campgrounds, and developed campgrounds. In general, each such development would permanently remove vegetation, alter the patterns of water flow, and, where developments extend to streambanks, require bank stabilization and hardening.

- Site upgrades or expansion - Actions associated with proposed site upgrades or expansions include building parking areas, constructing fire rings, and installing toilets. Although constructed parking areas represent a long-term commitment to allow continued use of user-created sites within riparian reserves, if properly located they can prevent undue soil damage caused by the presence of multiple unnecessary parking areas and spur roads. Likewise, though toilets represent a commitment to continued use of sites within riparian reserves, their presence would reduce the volume of human waste that enters surface water or is exposed to the elements and available for transport or incorporation into soils. The construction of fire rings may encourage the use of riparian forests as a source of firewood, though this use would likely occur regardless of whether or not constructed fire rings were present. Use of firewood at upgraded or expanded sites would be expected to increase if the proposed actions lead to increased visitor use.

- Site rehabilitation or relocation - Rehabilitation or relocation of sites would, in most cases, restore the potential for native plant communities to develop and, over the long-term, fulfill ecological functions such as sediment trapping, floodplain infiltration, and large wood recruitment.

- Trail construction and management - Construction and maintenance of new or existing trails (including former roads) will likely require clearing down wood from the path of trails. This will make down wood less stable and more likely to be removed from the locality, either by sliding downhill or by becoming entrained in river flows. Trails built in mid-slope positions may cause interception and rerouting of overland and subsurface flow paths. Trails built in low lying areas can redirect the flow of water through seasonally wet areas and can also cause trampling of seasonally wet soils and associated vegetation communities.

- Management of recreation opportunities (such as OHV use) - Management of recreation use levels and types varies between alternatives. In all alternatives, enforcement of existing regulations limiting OHV use to designated roads would decrease damage to riparian areas and have a beneficial impact on riparian reserves. Motorized boating would be restricted in Segments 1 and 2 and would not cause substantial impacts to riparian reserves in Segment 3.

**Road Management –** In all alternatives, there would be a net reduction in riparian road mileage in the reserves associated with both fish-bearing streams and other types of watercourses.

Many of the proposed road management actions within each alternative are designed to reduce sediment delivery, meadow damage, runoff generation, or alteration of hydrologic flow paths. In addition, some road treatments designed to accommodate increased recreation use would also address these concerns. As such, road decommissioning, obliteration, spot improvements, and contiguous improvements are collectively termed “restoration road treatments” for purposes of some discussions. These actions would reduce direct and indirect detrimental effects to riparian processes such as site productivity, infiltration, and sediment storage.

Roads that are open for motorized access require periodic maintenance that may have detrimental effects to riparian reserves. Falling and bucking of hazard trees and trees that have fallen across or near roads causes a reduction in the volume of stable CWD available to stream channels, floodplains, and riparian communities. Grading of road surfaces can deliver sediment to stream channels or riparian communities in adjacent low-lying areas, and may lead to the development of berms that divert flow paths. Road maintenance can remove riparian vegetation and disturb ditches and cutbanks that have been stabilized by vegetation cover.

Conversely, maintaining stream crossings, road drainage features, and road surfaces reduces the likelihood of stream crossing failure and diversion of flow paths onto roads.

Sediment delivery from newly constructed roads is often very high during the first few storms (Brown, 1983). Road construction within riparian reserves totals less than a mile in all alternatives, and would be done primarily to maintain access to areas while allowing more extensive road obliteration.

In order to reduce detrimental effects of roads and road management, best management practices will be implemented during road management activities within riparian reserves. These would include, among other things, installation of drainage features designed to prevent delivery of sediment and excess runoff to riparian areas, grading to minimize diversion of natural flow paths, installation of water bars, and minimal bucking of large wood.

The proposed removal and improvement of stream crossings would result in reduced impairment of the processes that control storage and transport of watershed products (water, sediment, CWD, and organisms). These actions would thus have a beneficial effect on the functionality of riparian reserves.

**Vegetation Treatments** – Vegetation treatments within riparian reserves will incorporate guidance from the Northwest Forest Plan and the KFRA RMP/ROD.

*Noxious Weeds* – Physical, biological, and chemical methods of noxious weed control would be implemented at known weed populations, including areas within riparian reserves. These actions would beneficially affect the diversity of riparian plant communities.

**PacifiCorp Facilities –** The minimum total footprint of PacifiCorp hydroelectric facilities within riparian reserves is about nine acres. This figure does not include parking areas and short spur roads, nor does it include low voltage

powerlines. In Segment 1, about 2.5 acres of BLM land and 3.5 acres of PacifiCorp land near the river are affected. In Segment 2, about 3 acres of BLM land are impacted.

It is assumed that these facilities would remain in all alternatives. In Alternative 3, one option to attain management objectives includes recommending altering and possibly removing some elements of the hydroelectric project. These actions would be dependent on the ongoing Federal Energy Regulatory Commission relicensing process, and additional NEPA analysis would occur prior to any such actions.

**Range Management –** The installation of fences around sensitive meadows (as proposed in the vegetation management section) would reduce utilization of grasses and shrubs by cattle and wild horses, thus reducing the extent of bare ground and enhancing the recovery of native plant communities. The extent of fencing varies by alternative.

## *Alternative 1*

**Recreation Management –** In Alternative 1, about 17 acres within riparian reserves would be directly impacted by recreation sites (see Table L-1). This level of development is lower than Alternatives 2 and 4 but higher than Alternative 3. In Segments 1 and 2, the majority of these impacts are on BLM land. In Segment 3, all of the impacts are on PacifiCorp land.

*Site development:* No new recreation sites would be developed within riparian reserves in this alternative.

*Site upgrades/expansion:* The upper bench portion of the Stateline recreation site would be upgraded and expanded. This could lead to increased recreation use in the adjacent riparian reserve.

*Site rehabilitation/relocation:* The dispersed camp sites on the west side of the river to the northwest of Frain Ranch would no longer be accessible by motorized vehicles. This would decrease recreation use at these sites.

*Trail network:* About 4.4 miles of trail would parallel the river within riparian reserves in Segments 2 and 3. Portions of the trail would be built on the bed of a decommissioned road and would not create any additional impacts (see Table L-2). An additional mile of trail would be constructed in areas more than 280 feet from fish-bearing streams.

*Recreation opportunities:* The installation of fences and obstructions on the perimeter of wet meadows (as proposed in the vegetation management section) would decrease OHV damage to riparian reserves.

Whitewater boating would remain at or near existing levels, and bank trampling would not be expected to increase.

The low frequency of vehicle patrols would continue to slightly reduce unauthorized activities that detrimentally affect riparian reserves, though impacts of OHV use and other activities would continue to occur in areas of high use (such as Frain Ranch).

**Road Management –** Of all alternatives, Alternative 1 would have the most limited program of restoration road treatments within riparian reserves. (See Tables L-3a, L-3b, L-4a and L-4b, as well as the Roads and Access section of this EIS).

Throughout the planning area about 27 miles of roads within riparian reserves would be open, seasonally open, or open to administrative access. Slightly more than 16 miles would be near fish-bearing streams (see Table L-5).

**Vegetation Treatments –** Less than 250 acres of vegetation management actions would occur within riparian reserves in Alternative 1. Less than 100 acres of treatments would occur near fish-bearing streams (see Table L-6).

*Riparian Vegetation:* Refer to the discussion of riparian areas within the Vegetation Management section of this EIS.

*Irrigated Meadows*: No restoration of the irrigated meadows on PacifiCorp land in Segment 3 would be recommended in this alternative.

*Upland Vegetation Treatments:* About 200 acres of upland vegetation types (dry meadow, oak woodlands, mixed brush, mixed conifer woodlands, and rabbitbrush/sagebrush) within riparian reserves would be affected by proposed actions, entirely on BLM land.

Vegetation management actions that occur within forest or woodland vegetation types (including oak and mixed conifer woodlands) would have the most effect on stream shading and large wood recruitment. About 170 acres of such treatments would occur within reserves, including about 90 acres near fish-bearing streams.

**Land Tenure** – The development of new coordinated management agreements for PacifiCorp land or land tenure adjustments is not proposed in this alternative. Some types of management of lands near watercourses would continue to adversely affect aspects of riparian structure and function.

**Cumulative Effects –** Due to the limited scope of actions designed to restore riparian processes, this alternative is likely to maintain, rather than restore, the functionality of riparian reserves and other land near riparian features.

Recreation facilities would affect about 17 acres within riparian reserves, which is more than Alternative 3 but less than Alternatives 2 and 4. No new sites would be constructed within riparian reserves.

Nine acres would continue to be directly impacted by hydroelectric facilities.

This alternative has the lowest level of road decommissioning and road improvements, and the highest open road mileage, within riparian reserves. Although some of the roads that cause the most impacts to riparian reserves would be decommissioned or relocated, roads would continue to deliver runoff and sediment to watercourses, and would adversely affect the function of riparian reserves.

## *Alternative 2*

**Recreation Management –** In Alternative 2, about 24 acres within riparian reserves and riparian corridors would be directly impacted by recreation sites (see Table L-1). This level of development is equivalent to Alternative 4, and is higher than Alternatives 1 and 3. In Segments 1 and 2, the majority of these impacts are on BLM land. In Segment 3, all of the impacts are on PacifiCorp land.

*Site development:* Site development in Alternative 2 is moderately extensive compared to other alternatives. One new site is proposed in both Segment 1 (a boat launch) and Segment 2 (a day use area), and two new sites (a boat launch and a campground) are proposed in Segment 3.

The proposed campground in Segment 3 would extend over approximately 5 acres of river terrace.

*Site upgrades/expansion:* In Alternative 2, proposed actions of this type are less extensive than in Alternative 4 and more extensive than in Alternatives 1 and 3.

Parking at two interpretive/fishing sites in Segment 1 would be improved, but the sites would not be substantially expanded. It is possible that the Topsy campground would be expanded in the future, although actions would be focused outside of the riparian reserve.

At the four sites within riparian reserves that will be upgraded in Segment 2, proposed actions include installing or replacing toilets at two sites, installing fire rings or picnic tables, or improving parking. A boat launch would be installed at Frain Ranch. None of the upgraded sites would be substantially expanded.

Facilities at the Stateline boat launch and at Access 5, Access 4, Access 3, and Access 2 would be upgraded. The camping area on the upper bench at Stateline (outside of the riparian reserve) would be expanded. These actions would increase recreation use within nearby riparian reserves.

*Site rehabilitation/relocation:* Limited site rehabilitation or relocation would occur in Segment 2 in this alternative.

The dispersed camp sites on the west side of the river to the northwest of Frain Ranch would no longer be accessible by motorized vehicles. This would decrease recreation use at these sites.

One site in the Klamath River Campground would be relocated away from a sensitive riparian area. One of the camp sites in the Turtle Camp area would be relocated, though it would remain within the riparian reserve and would be closer to the river.

*Trail network:* An extensive trail network would cross through area near streams in all segments of the planning area. Most of the new trails would require new construction (see Table L-2).

*Recreation opportunities:* Supplying information through an enhanced education program, increased monitoring of OHV use, and the installation of fences and obstructions on the perimeter of wet meadows (as proposed in the Vegetation Management section) would decrease damage to riparian reserves.

Increase management presence would reduce unauthorized activities that damage riparian reserves to continue, though perhaps not as effectively as the on-site presence proposed in Alternative 4.

**Road Management –** There would be an overall decrease in road mileage within riparian reserves in this alternative, although riparian road mileage in Segment 1 would increase slightly.

Alternative 2 would have the most extensive program of restoration road treatments within riparian reserves. (See Tables L-3a, L-3b, L-4a and L-4b, as well as the Roads and Access section of this EIS).

Throughout the planning area about 22 miles of roads within riparian reserves would be open, seasonally open, or open to administrative access. Slightly more than 14 miles are near fish-bearing streams (see Table L-5).

**Vegetation Treatments –** Over 1,300 acres of vegetation management actions would occur within riparian reserves in Alternative 2, including more than 700 acres of treatments near fish-bearing streams (see Table L-6).

*Riparian Vegetation:* Refer to the discussion of riparian areas within the Vegetation Management section of this EIS.

*Irrigated Meadows*: It would be recommended that the 370 acres mapped as irrigated meadows on PacifiCorp land in Segment 3 be managed to restore native plant communities appropriate for the site. Natural patterns of inundation and infiltration would be restored through the use of irrigation infrastructure and earthmoving.

*Upland vegetation treatments:* About 830 acres of upland vegetation types (dry meadow, oak woodlands, mixed shrub, mixed conifer woodlands, and rabbitbrush/sagebrush) near watercourses would be affected by proposed actions. About 620 acres of these treatments would occur on BLM land. Exposed areas resulting from these treatments would potentially deliver runoff and sediment to stream channels until ground cover returns.

Vegetation management actions that occur within forest or woodland vegetation types (including oak and mixed conifer woodlands) would have the most effect on stream shading and large wood recruitment. About 640 acres of such treatments would occur near watercourses, including about 370 acres near fish-bearing streams and 35 acres near wetlands greater than one acre in size. About 490 acres, including 330 acres near fish-bearing streams and 5 acres near large wetlands, would be affected on BLM land.

*Noxious Weeds:* Post-project surveys would ensure that project implementation does not lead to establishment of new weed populations.

**Land Tenure –** If undertaken, the development of cooperative management agreements or land tenure adjustments for PacifiCorp lands containing riparian reserves adjacent to the river or along the mainstem of Shovel and Negro Creeks would likely result in enhanced riparian resource values.

**Cumulative Impacts –** Actions proposed in this alternative would have a relatively high likelihood of maintaining or restoring riparian reserve functionality.

Twenty-five acres within riparian reserves would be impacted by recreation facilities, including five new sites within riparian reserves.

Nine acres would continue to be directly impacted by hydroelectric facilities.

The extent of road decommissioning and obliteration in riparian reserves would be slightly less, and open road mileage would be slightly higher, than in Alternative 3. Less road improvements would occur than in Alternative 4, but more would occur than in Alternative 1 and 3.

## *Alternative 3*

**Recreation Management –** In Alternative 3, about 9 acres within riparian reserves would be directly impacted by recreation sites (refer to Table L-1). Of all alternatives, Alternative 3 has the lowest level of recreation development. In Segments 1 and 2, the majority of these impacts are on BLM land. In Segment 3, all of the impacts are on PacifiCorp land.

*Site development:* Site development within riparian reserves in Alternative 3 is limited and includes only one site in Segment 3.

*Site upgrades/expansions:* No site upgrades within riparian reserves are proposed in this alternative.

*Site rehabilitation/relocation:* Rehabilitation or relocation of sites within riparian reserves is most extensive in this alternative. All sites within the Klamath River campground would be moved to 100 feet from the high water line of the river. This would reduce, but not eliminate, the direct impacts to riparian reserves associated with this campground. Motorized access will be limited and site rehabilitation will occur in the Turtle Camp area and on both sides of the river in the vicinity of Frain Ranch. These actions would benefit the functionality of riparian reserves.

The raft launch area and campsites on the lower bench at Stateline will be relocated to Access 6. There would be minor benefits to riparian values as a result of removing an existing recreation site and, potentially, decommissioning the access road.

*Trail network:* A limited trail network would be constructed along the river, primarily in Segment 2. A portion of the trail network would utilize existing roads, thereby reducing the impact of creating the trail system. Trail mileage near the river in this alternative is lower than in Alternatives 2 and 4 (see Table L-2).

*Recreation opportunities:* Extensive fencing and installation of obstructions around wet meadows (as proposed in the vegetation management section) would reduce detrimental impacts of OHV use in riparian reserves.

Reduced levels of whitewater recreation would reduce bank trampling.

Reduced management presence might allow some unauthorized activities that damage riparian reserves to continue.

**Road Management –** There would be an overall decrease in road mileage within riparian reserves in all segments of the planning area in this alternative. This alternative has the highest level of road decommissioning within reserves.

Alternative 3 would have an extensive program of restoration road treatments within riparian reserves. (See Tables L-3a, L-3b, L-4a and L-4b, as well as the Roads and Access section of this EIS). Proposed road improvements are more extensive than in Alternative 1, but less than in Alternatives 2 and 4. The limited extent of road improvements in this alternative could allow ongoing sediment delivery, though this would be mitigated by road decommissioning and relatively low levels of traffic.

Throughout the planning area about 23 miles of roads within riparian reserves would be open, seasonally open, or open to administrative access, including about 13 miles near fish-bearing streams (see Table L-5).

**Vegetation Treatments –** Over 1,750 acres of vegetation management actions would occur within riparian reserves in Alternative 3, including more than 850 acres of treatments near fish-bearing streams (see Table L-6).

*Riparian Vegetation:* Refer to the discussion of riparian areas within the Vegetation Management section of this EIS.

*Irrigated Meadows*: It would be recommended that the 370 acres mapped as irrigated meadows on PacifiCorp land in Segment 3 be managed to restore native plant communities appropriate for the site. Natural patterns of inundation and infiltration would be restored through the use of irrigation infrastructure and earthmoving.

*Upland vegetation treatments:* About 1,140 acres of upland vegetation types (dry meadow, oak woodlands, mixed shrub, mixed conifer woodlands, and rabbitbrush/sagebrush) near watercourses would be affected by proposed actions. About 770 acres of these treatments would occur on BLM land.

Vegetation management actions that occur within forest or woodland vegetation types (including oak and mixed conifer woodlands) would have the most effect on stream shading and large wood recruitment. About 840 acres of such treatments would occur near watercourses, including about 440 acres near fish-bearing streams and 45 acres near wetlands greater than one acre in size. More than 600 acres, including 390 acres near fish-bearing streams and 5 acres near large wetlands, would be affected on BLM land.

*Noxious Weeds*: Post-project surveys would ensure that project implementation does not lead to establishment of new weed populations.

**Land Tenure –** If undertaken, the development of coordinated management agreements or land tenure adjustments for PacifiCorp lands containing riparian reserves adjacent to the river and throughout Segment 3 would likely result in enhanced riparian resource values.

**Cumulative Impacts –** Actions proposed in this alternative would have the highest likelihood of maintaining or restoring riparian reserve functionality.

Recreation impacts to riparian processes would be much less extensive than in Alternatives 2 and 4, though some site clearing and installation of impervious surfaces would occur.

Nine acres would continue to be directly impacted by hydroelectric facilities.

This alternative has the highest level of road decommissioning and obliteration and the lowest open road mileage within riparian reserves. Overall, road management actions proposed in this alternative would have the highest likelihood of supporting the functionality of riparian reserves.

Potential management agreements or land tenure adjustments would benefit the function of riparian reserves along the river and many perennial and intermittent tributary streams.

## *Alternative 4*

**Recreation Management –** In Alternative 4, a minimum of about 25 acres within riparian reserves would be directly impacted by recreation sites (see Table L-1). In Segments 1 and 2, the majority of these impacts are on BLM land. In Segment 3, the gross majority of the impacts are on PacifiCorp land.

*Site development:* Site development in Alternative 4 is the most extensive of all alternatives.

One new site (a boat launch immediately downstream form J.C. Boyle Dam) is proposed within riparian reserves in Segment 1, and an additional site outside of the riparian reserve (the campground at Big Bend) would result in more foot traffic through riparian reserves along the river. Three new sites, including two boat launch areas and a campground would be developed within riparian reserves in Segment 2. Two new sites would be developed in Segment 3: a boat launch area at Access 6 and a large campground in the meadow west of the mouth of Shovel Creek.

The larger of the two proposed campgrounds in Segment 3 would extend over approximately 5 acres of river terrace.

*Site upgrades/expansion:* Two sites in Segment 1, seven sites in Segment 2, and five sites in Segment 3 would be upgraded or expanded.

Parking at two interpretive/fishing sites in Segment 1 would be improved, but the sites would not be substantially expanded.

In Segment 2, proposed actions include installing or replacing toilets at 5 sites, installing fire rings or picnic tables, or improving parking. Boat launch facilities would also be added at Frain Ranch.

Two of the upgraded sites in Segment 2 would also be substantially expanded. The Klamath River Campground would be expanded to accommodate increased use, and portions of the riparian reserve would be affected. New camp sites, new group sites, utilities, and a boat launch would be added at this site. In the Turtle Camp area, a third site would be added.

In Segment 3, facilities at the Stateline boat launch and at Access 5, Access 4, Access 3, and Access 2 would be upgraded.

*Site rehabilitation/relocation:* Relocation of sites within riparian reserves will occur to a very limited extent in this alternative, and will be focused along the river. One of the camp sites in the Turtle Camp area would be relocated, though it would remain within the riparian reserve and would be closer to the river.

*Trail network:* This alternative proposes an extensive trail network, including trails along the river and parallel to Shovel Creek (see Table L-2). Most of the trails would require new construction and vegetation removal. The trail adjacent to Shovel Creek would pass through or near well developed riparian hardwood forests and numerous small wet meadows.

*Recreation opportunities:* In addition to enhanced outreach to OHV users and increased monitoring of OHV use, the installation of fences and obstructions on the perimeter of wet meadows (as proposed in the vegetation management section) would decrease OHV use in riparian areas and thus reduce detrimental impacts to riparian reserves.

Increased levels of whitewater recreation would cause more bank trampling.

Motorized boating in Segment 3 could create wakes that would increase bank erosion and detrimentally impact bank vegetation.

The presence of an on-site caretaker or seasonal employee at the Powerhouse site, Hoover Ranch, Lower Frain Ranch, and the Beswick area would reduce unauthorized activities (such as OHV use) that cause detrimental impacts to areas near streams and wetlands.

**Road Management –** There would be an overall decrease in road mileage within riparian reserves in this alternative, although riparian road mileage in Segment 1 would increase slightly. Numerous roads within riparian reserves would be improved to accommodate increased recreation use.

Alternative 4 would have a moderately extensive program of restoration road treatments within riparian reserves. (See Tables L-31, L-3b, L-4a and L-4b**,** as well as the Roads and Access section of this EIS).

Alternative 4 has the greatest extent of roads that would be open for varying periods of time. Throughout the planning area about 27 miles of roads within riparian reserves would be open, seasonally open, or open to administrative access, including about 16 miles near fish-bearing streams (refer to Tables L-3a, L-3b, L-4a and L-4b,

**Vegetation Treatments –** Over 960 acres of vegetation management actions would occur within riparian reserves in Alternative 4, including about 450 acres of treatments near fish-bearing streams (refer to table L-5).

*Riparian Vegetation:* Refer to the discussion of riparian areas within the Vegetation Management section of this EIS.

*Irrigated Meadows:* No restoration of the irrigated meadows on PacifiCorp land in Segment 3 would be recommended.

*Upland Vegetation Treatments:* About 920 acres of upland vegetation types (dry meadow, oak woodlands, mixed shrub, mixed conifer woodlands, and rabbitbrush/sagebrush) near watercourses would be affected by proposed actions. About 640 acres of these treatments would occur on BLM land.

Vegetation management actions that occur within forest or woodland vegetation types (including oak and mixed conifer woodlands) would have the most effect on stream shading and large wood recruitment. About 660 acres of such treatments would occur near streams and wetlands, including about 370 acres near fish-bearing streams and 35 acres

near wetlands greater than one acre in size. 490 acres, including 330 acres near fish-bearing streams and five acres near large wetlands, would be affected on BLM land.

*Noxious Weeds* – Surveys near popular recreation sites would ensure that increased recreation use does not lead to establishment of new weed populations in areas near watercourses.

**Land Tenure –** If undertaken, the development of cooperative management agreements or land tenure adjustments for lands containing riparian reserves adjacent to the river and throughout Segment 3 would likely result in enhanced riparian resource values.

**Cumulative Impacts** – Actions proposed in this alternative would have a moderate likelihood of maintaining or restoring riparian reserve functionality.

This alternative would have the highest number of recreation sites, and the greatest level of recreation use, within riparian reserves, including seven new sites. Overall, about 25 acres within riparian reserves would be impacted by recreation developments.

Nine acres would be directly impacted by hydroelectric facilities.

The magnitude of reductions in road mileage within riparian reserves would be lower than Alternatives 2 and 3 but higher than Alternative 1. This alternative has the highest level of road improvements within riparian reserves (slightly more than Alternative 2). Open road mileage within riparian reserves in this alternative is about the same Alternative 1.

### Irretrievable, Irreversible, and Unavoidable Impacts

Proposed campgrounds, boat launch facilities, bridges, and roads would permanently (though not irreversibly) remove vegetation and affect hydrologic and geomorphic processes over a small portion of the total area near streams and wetlands.

## Evaluation of ACS Objectives

This section will essentially be a discussion of the cumulative effects of proposed actions on the values described in the nine ACS objectives. The discussion will summarize, for each alternative, whether and how proposed actions will lead to the maintenance of high quality aquatic/riparian habitat and the restoration of degraded aquatic/riparian habitat. In addition, the extent of "maintenance" and "restoration" actions will be compared relative to the "decision-making space" framed by Alternative 1 (no change in management direction) and Alternative 3 (comprehensive restoration). In some cases, it will be possible to maintain or restore conditions without addressing the issues that are most significant or are the cause of ongoing resource concerns.

If it is determined that proposed actions would prevent attainment of ACS objectives over the long-term, management options to improve conditions would be developed. These could range from modifying proposed actions to removing from consideration those proposed actions (or elements of proposed actions) that would prevent attainment. The appropriate management option depends on the condition and functionality of the rest of the planning area, the beneficial uses that occur, and the extent of other actions that restore processes to within the range of natural variability (Final SEIS, vol. II, page B-83). In all cases, actions would be designed and implemented so that, at a minimum, they would not retard or prevent attainment of ACS objectives.

Refer to Table L-7 for a summary and comparison of the effects of proposed actions on ACS objectives.

### *Alternative 1*

#### ***Objective 1: "Watershed and landscape-scale features"***

*Some enhancement of watershed-level features and vegetation communities would occur under this alternative. Implementation of fuels management actions consistent with the RMP and Fuels Management EA to reduce fuel loading and increase mast crops for wildlife would be expected to protect the existing diversity and complexity of the*

*vegetation community within the canyon in the long term (greater than ten years). However the rate of recovery would be the lowest when compared to the other three alternatives.*

As a result of the level of actions proposed under this alternative, a short term (over the next ten years) risk would exist to degrade watershed level features as a result of catastrophic fire. Only a small percentage of the planning area vegetation would be treated per year (on average) under this alternative. High fuel loading and ladder fuels currently present within the planning area stands, increases the risk and extent of potential wild fires within the canyon. Massive loss of the vegetation community within the canyon would substantially alter the landscape within the canyon. The distribution, diversity, and complexity of the watershed would be highly altered as a result of large scale stand replacement fires. Depending on the scale and intensity of these fires, species adapted to the unique environment within the canyon would lose the watershed and landscape features that currently offer protection.

***Objective 2: "Spatial and temporal connectivity"***

The lateral connectivity of the river to adjacent riparian areas in Segment 2 and 3 would continue to be adversely affected by flow ramping at the powerhouse. No actions would be taken to accelerate the recovery of stream channel – floodplain connectivity. The lateral connectivity within riparian areas, and of riparian areas to adjacent upland areas, would be improved by road decommissioning and by stream crossing enhancements.

The lateral connectivity of instream habitats within the river would remain impaired under this alternative. Peaking operation of the J.C. Boyle facility results in daily dewatering of bank habitat. Proposed instream streamflows (per BLM water right claims) would reduce, but not eliminate, the effect of this loss of aquatic habitat by increasing baseflows. However bank habitats along the edge of the active channel would remain inaccessible during base summer flows

Road decommissioning or stream crossing enhancement would improve the longitudinal connectivity of riparian areas along some watercourses. Longitudinal connectivity along the river would continue to be impaired by sidecast material in Segment 1, water temperature gradients at the powerhouse, and the patchy distribution of riparian vegetation other than reed canary grass. Connectivity between the river within the planning area and adjacent river reaches, and with nearby key watersheds, would continue to be impaired by hydroelectric facilities.

Overall, connectivity within the planning area would be restored somewhat, but overall would not be substantially improved relative to the current condition.

***Objective 3: "Physical integrity"***

Channel configurations in the river would continue to be adversely affected by the design and operation of the J.C. Boyle facility.

The existing condition of the river, which reflects past effects of the presence and operation of the J.C. Boyle facility, as well as other past and/or ongoing land use effects (including construction of bridges and irrigation diversions, grazing, and historic log drives), would not be restored. The effects of the road sidecast in Segment 1 would not be addressed.

Currently degraded habitat conditions in some tributary streams would not be addressed, but could recover over the long-term. Conditions in other streams would continue to respond to dis-equilibrium between watershed conditions and channel form by widening and incising. Current conditions would not be maintained. In the long-term, the physical integrity of the aquatic system in the river, including shorelines, banks and bottom configurations, would be further degraded relative to current conditions.

Within the Planning Area the ongoing alterations in streamflow and sediment regimes would be expected to directly alter the dimensions of the stream channel (Rosgen 1996). The reduced supply of coarse sediment, coupled with the release of peaking flows, has likely resulted in continued channel widening, incision, and substrate armoring. The no-action alternative would not meet the intent of this objective by continuing to degrade the channel.

***Objective 4: "Water quality"***

Assuming the Upper Klamath Lake and scheduled Upper Klamath River TMDLs/WQRPs are implemented, water quality in the planning area would eventually improve.

Water quality in the lower portion of Segment 1 would continue to be of a different character than water quality in the rest of the river, and the water quality and temperature gradient that exists at the powerhouse would persist. Warming rates and DO levels in Segment 1 would continue to be affected by the diversion at J.C. Boyle Dam. Maximum daily temperatures and warming rates in Segments 2 and 3 would be reduced as a result of increased baseflows.

Withdrawals from Shovel and Negro Creeks would not be altered. These diversions likely have an adverse effect on water temperature in these streams.

Overall, there would be slight improvements in certain water quality parameters, although important water quality concerns (and the effects of altered water quality on beneficial uses) in the planning area would not be comprehensively addressed.

***Objective 5: "Sediment regime"***

The supply of coarse sediment in the river would continue to be reduced by the presence of J.C. Boyle Dam. Although some coarse sediment is supplied to the river from hillslopes and bank erosion, this supply is likely relatively minor compared to that which is transported in the Keno reach of the river and in Spencer Creek (and is subsequently captured in J.C. Boyle Reservoir).

The timing and duration of sediment entrainment and transport would continue to be affected by peaking operations at the powerhouse. These operations release flows on the order of 3,000 cfs, which are nearly equivalent to the calculated 1.5-year recurrence interval flow in Segment 2.

The supply of fine sediment from roads and the use of the emergency spillway would be reduced.

Although ongoing effects to coarse sediment supply and transport would not be addressed, the duration of peaking flows would be reduced and existing sediment regimes would generally be maintained or slightly improved.

***Objective 6: "Instream flows"***

The BLM proposed instream flow would be based on water rights claims for fisheries and recreational values. Additional increases in baseflow may be recommended as part of FERC relicensing of the Klamath Project. The flow regime that would occur within the planning area, including peaking for power production, would reflect flow patterns that have been occurring since the construction of the J.C. Boyle facility.

Spatial and temporal distribution of peak, high, and low flows would continue to be altered compared to unimpaired flows. The effects of flow regulation at Upper Klamath Lake, in combination with the diversion and releases related to hydropower generation at J.C. Boyle, results in higher and earlier peak flows, decreased summer minimum flows, and greater annual flow variability (BHI 1996). Summer baseflows would be expected to be enhanced below the powerhouse, as a result of BLM water claims, to benefit aquatic species. The duration of peaking flows would be reduced in order to provide elevated baseflows during late spring and summer months. However, the impacts to physical process resulting from the increased duration of channel forming flows (during periods when both turbines at the J.C. Boyle powerhouse are operating) would be expected to continue.

Water level fluctuations associated with powerhouse operations would be highest in this alternative.

The streamflows proposed in this alternative, while continuing to limit channel processes, would constitute a minor improvement over existing conditions.

***Objective 7: "Floodplain inundation and water table elevation"***

Floodplain inundation along the river likely occurs only during flows in excess of about 3,300 cfs. Flows at or below this level are likely sufficiently frequent that the shape of the channel has adjusted to convey these flows without inundating the minor floodplains that occur in Segments 1 and 2. The magnitude and frequency of flow fluctuations caused by peaking operations at the powerhouse would be reduced, thereby partially addressing concerns regarding the effects of frequent inundation and exposure of riparian areas.

Irrigation of the terraces and relic floodplains in Segment 3 mimics natural inundation somewhat, though the duration and frequency of inundation during summer and fall months does not mimic natural patterns.

Actions designed to restore floodplain connectivity in tributary streams are not proposed in this alternative. Stream channels are in the process of recovering from past land use and are adjusting to flows and sediment supplied from their upper watersheds, and new floodplains are forming (at lower elevations and of narrower widths than the relic floodplains).

Current water table elevations in upland wet meadows are sufficient to support riparian vegetation communities. Human modifications to flow paths affect the extent of inundation in some areas, but would not be addressed in this alternative. Upslope treatments could increase the amount of water available in a few wet meadows.

Overall, the processes driving floodplain inundation and water table elevation would be maintained.

***Objective 8: "Plant communities"***

The hydrologic and geomorphic processes that influence the extent and character or riparian vegetation communities would continue to be affected by the presence and operation of the J.C. Boyle hydroelectric facility. Ramping in Segments 2 and 3 would continue to affect the frequency, timing, and magnitude of flow fluctuations, and would confer a competitive advantage plant species (such as reed canary grass) that reproduce vegetatively, and can tolerate such flow regimes (Conchou and Fustec, 2001). Irrigated meadows in Segment 3 would continue to support mainly non-native species.

Downstream from the powerhouse, increased baseflows would reduce the magnitude of daily flow fluctuations, thus reducing the lateral extent of the area affected by ramping. The extent of riparian vegetation along the river would continue to be limited by the lack of alluvial surfaces (due in part to altered sediment regimes, refer to the discussion of Objective 5) and, in Segment 1, the effect of the side cast material. Ongoing channel widening would eventually lead to reductions in the extent of riparian areas along some portions of the river.

Other proposed actions in or adjacent to riparian areas (recreation developments, road decommissioning, vegetation treatments, and exclosure construction) would have a moderate net beneficial effect on riparian communities along the river and tributary streams (though less so than in Alternatives 2 and 3).

Riparian areas along tributary streams and in wet meadows would be maintained or restored. Riparian areas along the river would be maintained and would continue to resemble the existing communities.

***Objective 9: "Habitat"***

The proposed road treatments and increased based flows within the no-action alternative would be expected to maintain and potentially enhance the condition of existing habitats within the planning area. This alternative would do the least to increase access to and quality of habitats within the planning area.

## *Alternative 2*

***Objective 1: "Watershed and landscape-scale features"***

A moderate level of enhancement of landscape level features, such as forested communities and floodplain and terrace wet meadows, would occur under this alternative. Reduced fuel loading and increased diversity of terrestrial habitats

within the planning area would be expected to have beneficial impacts on the vegetation community, thereby protecting the diversity and complexity of landscape scale features within the canyon in the long term (greater than ten years).

The short term (over the next ten years) risk of catastrophic fire occurring within the planning area would be reduced, due to accelerated rates of fuels management in the canyon. The distribution, diversity, and complexity of the watershed would be protected from extensive stand replacement fires as a result.

The degree of proposed landscape scale treatments would be expected to have an increased recovery over actions proposed in Alternative 1, and less than those actions proposed in Alternatives 3 and 4.

***Objective 2: "Spatial and temporal connectivity"***

The lateral connectivity within riparian areas, and of riparian areas to adjacent upland areas, would be improved by road decommissioning and by stream crossing enhancements.

The lateral connectivity of aquatic habitat may remain partially impaired with continued peaking flows during spring and summer months under this alternative. However, active restoration efforts would be conducted to increase lateral connectivity of aquatic habitats within the planning area. Installation of bankfull benches in Segment 1, proposed channel enhancements in all segments, treatment of side channels, and sediment augmentation would be expected to restore connections between riparian and aquatic interfaces by reducing the extent of exposed substrate during peaking operations.

Road decommissioning or stream crossing enhancement would improve the longitudinal connectivity of riparian areas along some watercourses. Longitudinal connectivity would be enhanced by instream streamflow alterations that reduce temperature gradients. Longitudinal connectivity between the river within the planning area and upstream reaches, and an upstream key watershed, would be improved with alteration of fish passage facilities at the J.C. Boyle hydroelectric facilities. Longitudinal connectivity for fish species between the river within the planning area and downstream reaches, and with a downstream key watershed, would generally continue to be impaired by hydroelectric facilities. Connectivity between the river within the planning area and adjacent river reaches, and with nearby key watersheds, would continue to be impaired by hydroelectric facilities.

Some alteration of longitudinal connectivity between Segment 1 and J.C. Boyle reservoir would occur as a result of water releases designed to provide increased baseflow in the bypass reach. Most flow is screened from downstream movement to the planning area reaches; 10 to 50 cfs is released for the fish ladder. Augmentation of flow released thru unscreened spillways would provide enhanced downstream connectivity.

Connectivity within the planning area would be enhanced and substantial enhancements in riparian–channel connectivity would occur. Due to continued peaking impacts, however, the overall benefits of proposed projects may be temporally and spatially limited.

***Objective 3: "Physical integrity"***

The effects of the J.C. Boyle facility on channel morphology in the mainstem would be mitigated by a combination of passive (i.e., gravel augmentation) and active (i.e., installation of structural features) restoration actions. These actions would also address the effects of other past or ongoing land use activities, and would reduce bank erosion and channel widening.

Degraded habitat conditions in some tributary streams would be addressed by a limited program of instream restoration. The diversion structure in Negro Creek would no longer require maintenance (which involves straightening of short lengths of stream channel).

The physical integrity of the aquatic system in the river, including shorelines, banks and bottom configurations, would be restored to a moderate degree relative to the current degraded condition.

***Objective 4: "Water quality"***

Assuming the Upper Klamath Lake and scheduled Upper Klamath River TMDLs/WQMPs are implemented, water quality in the planning area would eventually improve.

The difference in water quality between the downstream end of Segment 1 and the area immediately downstream from the powerhouse would be reduced as a result of increased baseflows released from the dam. Warming rates and DO levels in Segment 1 would continue to be affected by the diversion at J.C. Boyle Dam. Maximum daily temperatures and warming rates in Segments 2 and 3 would be reduced as a result of increased baseflows.

It would be recommended that the timing and magnitude of irrigation withdrawals from Shovel Creek would be altered to reduce adverse impacts to water quality, and that the diversion on Negro Creek be removed. If implemented, these actions would reduce the rate of warming in the lower portion of Shovel Creek.

This alternative proposes an approach that would address the most critical water quality concerns within the planning area, and would have a moderate likelihood of resulting in improved water quality and beneficial uses.

***Objective 5: "Sediment regime"***

The supply of coarse sediment in the river would continue to be affected by the presence of J.C. Boyle Dam. In this alternative, a program of sediment replenishment would be designed to deliver coarse sediment at one or more locations to augment the existing supply to the river downstream from the dam. Although the timing and magnitude of replenishment events would mimic natural processes as closely as possible, practical constraints would prevent complete restoration of the sediment regime. For instance, the timing of sediment replenishment events might not be coincident with peak flow events, due to limited road access during the wet season.

The timing and duration of sediment entrainment and transport would continue to be affected by peaking operations at the powerhouse. These operations release flows on the order of 3,000 cfs, which are nearly equivalent to the calculated 1.5-year recurrence interval flow in Segment 2. The combination of increased sediment supply and increased sediment storage capacity (near CWD placements, for instance) would serve to reduce the net rate at which sediment is exported from the planning area.

The possible onset of weekend recreation flow releases in Segment 1 would not be likely to substantially affect transport of coarse sediment, since the flows would probably not be of sufficient magnitude to entrain coarse material.

The supply of fine sediment originating from roads and the use of the emergency spillway would be reduced.

Ongoing effects to the supply and transport of fine and coarse sediment would be addressed. A moderate level of restoration of sediment regimes would occur.

***Objective 6: "Instream flows"***

The BLM would recommend a "modified run-of-the-river" flow regime that would be based in part on water rights claims for fisheries and recreational values. This flow regime would restore key aspect of unimpaired flows, such as higher baseflow and reduced magnitude, frequency, and rate of change of flow fluctuations.

The timing and magnitude of peak and low flows would continue to be altered from unimpaired flows. Flow regulation at Upper Klamath Lake, in combination with the diversion and releases related to hydropower generation at J.C. Boyle, results in higher and earlier peak flows, decreased summer minimum flows, and greater annual flow variability (BHI 1996). Summer baseflows would be enhanced below the powerhouse, to benefit aquatic species. The duration of peaking flows would be reduced in order to emulate natural flow regimes more closely and provide elevated baseflows during late spring and summer months. The occurrence of powerhouse outflows that are near the historic annual average peak flow would be reduced.

Stage fluctuations associated with powerhouse operations would still occur, but would be reduced relative to current conditions. The lateral extent of the area affected by fluctuating flows would be reduced as a result of in-stream restoration projects.

The streamflow regimes proposed in this alternative would constitute a substantial improvement over existing conditions.

***Objective 7: "Floodplain inundation and water table elevation"***

Floodplain inundation along the river likely occurs during flows in excess of about 3,300 cfs. Flows at or below this level are likely sufficiently frequent that the shape of the channel has adjusted to convey these flows without inundating the minor floodplains that occur in Segments 1 and 2. The magnitude and frequency of flow fluctuations caused by peaking operations at the powerhouse would be reduced, and the timing of seasonal flow patterns would be partly restored, thereby addressing concerns regarding the effects of frequent inundation and exposure of riparian areas.

It would be recommended that irrigation of the meadows in Segment 3 be adjusted to reduce impacts to fisheries and aquatic resources, and occur earlier in the growing season. This would more closely mimic natural patterns and timing of floodplain inundation.

Actions designed to restore channel processes and floodplain connectivity are proposed for portions of Hayden Creek, Shovel Creek, and, potentially, other fish-bearing streams. These actions would likely restore connectivity with portions of relic floodplains that are rarely inundated at present.

Current water table elevations in upland wet meadows are sufficient to support riparian vegetation communities. Human modifications to flow paths affect the extent of inundation in some areas, but would not be addressed in this alternative. Upslope treatments could increase the amount of water available in numerous wet meadows.

Overall, the processes driving floodplain inundation and water table elevation would be maintained and restored, and the intent of this objective would be met.

***Objective 8: "Plant communities"***

The effects of the J.C. Boyle hydroelectric facility on the hydrologic and geomorphic processes that influence the extent and character of riparian vegetation communities would be greatly reduced. Regardless, ramping in Segments 2 and 3 to attain recreation flows would continue to affect the frequency, timing, and magnitude of flow fluctuations, and would confer a competitive advantage plant species (such as reed canary grass) that reproduce vegetatively and can tolerate such flow regimes (Conchou and Fustec, 2001). Downstream from the powerhouse, increased baseflows would reduce the magnitude of daily flow fluctuations, thus reducing the lateral extent of the area affected by ramping.

The extent of alluvial surfaces capable of supporting riparian vegetation would increase as a result of active and passive restoration measures.

Other proposed actions in or adjacent to riparian areas (recreation developments, road decommissioning, vegetation treatments, and exclosure construction) would, overall, have a moderate net beneficial effect on riparian communities along the river and tributary streams.

Overall, a moderate degree of active and passive restoration of riparian communities would occur in this alternative.

***Objective 9: "Habitat"***

Alternative 2 would maintain and enhance riparian areas and upland habitats located throughout the watershed over an indefinite time period. The proposed vegetation treatments would enhance these habitats to support well-distributed populations of native plant, invertebrate, and vertebrate riparian-dependent species. Alternative 2 is expected to maintain this objective in the short-term and would restore habitat through vegetation recovery over the long-term. When compared to Alternative 4, this alternative would be approximately equal in condition improvements, but would be less than those efforts proposed under Alternative 3.

## *Alternative 3*

***Objective 1: "Watershed and landscape-scale features"***

Extensive enhancement of landscape level features, such as forested communities, wet meadows, and riverine riparian areas, would occur under this alternative. Reduced fuel loads and increased diversity of terrestrial habitats within the planning area would be expected to have beneficial impacts on the vegetation community, thereby protecting the diversity and complexity landscape scale features within the canyon in the long term (greater than ten years).

The short term (over the next ten years) risk of catastrophic fire occurring within the planning area would be reduced, due to accelerated rates of fuels management in the canyon. The distribution, diversity, and complexity of the watershed would be protected from extensive stand replacement fires as a result.

The alternative would have the highest rate of treatment and thus bring fuel loading and vegetation conditions within the natural range of variation within the shortest time period when compared to Alternatives 1, 2, and 4.

***Objective 2: "Spatial and temporal connectivity"***

The lateral connectivity within riparian areas, and of riparian areas to adjacent upland areas, would be improved by road decommissioning and by stream crossing enhancements.

The lateral connectivity of aquatic habitat would be largely restored under this alternative. Artificial peaking flows would generally be eliminated or reduced in all segments, minor fluctuation within the natural range of variability for the system may continue, under this alternative. In addition active restoration efforts would be conducted to increase lateral connectivity of aquatic habitats within the planning area. Removal of sidecast in Segment 1, proposed channel enhancements in all segments, treatment of side channels, and sediment regime restoration would be expected to restore connections between riparian and aquatic interfaces. These would occur as a result of increased water depths, increased bank habitat, and the reduced extent of exposed substrate during low flow periods.

Road decommissioning or stream crossing enhancement would improve the longitudinal connectivity of riparian areas along some watercourses. Longitudinal connectivity would be enhanced by instream streamflow alterations that reduce temperature gradients. Longitudinal connectivity between the river within the planning area and upstream reaches, and an upstream key watershed, would be improved with alteration of fish passage facilities at the J.C. Boyle hydroelectric facilities. Longitudinal connectivity for fish species between the planning area and downstream river reaches would continue to be impaired by hydroelectric facilities. Longitudinal connectivity would remain impaired for most other aquatic and riparian dependant species between the planning area, all other reaches, and key watersheds, by hydroelectric facilities within the river and riparian areas that obstruct or hinder corridors of migration.

Alteration of longitudinal connectivity of Segment 1 to J.C. Boyle reservoir would occur as a result water releases for geomorphic flows and increased baseflows. Currently most flow is screened from downstream movement to the planning area reaches; 10 to 50 cfs is released for the fish ladder. Augmentation of flow released through unscreened spillways would provide enhanced downstream connectivity.

Connectivity within the planning area would be enhanced and substantial enhancements in riparian –channel connectivity would occur. This alternative provides the greatest potential for recovery of spatial and temporal connectivity of the planning area to upper river reaches and the Spencer Creek Key Watershed.

***Objective 3: "Physical integrity"***

The effects of the J.C. Boyle facility on channel morphology in the mainstem would be mitigated by either (1) a combination of passive (i.e., gravel augmentation) and active (i.e., installation of structural features) restoration actions, and/or (2) removing the J.C. Boyle facility. If implemented, instream restoration actions would also address the effects of other past or ongoing land use activities, and would reduce bank erosion and channel widening.

Degraded habitat conditions in some tributary streams would be addressed by an extensive program of instream restoration. The diversion structures in Shovel and Negro Creeks would no longer require maintenance (which involves straightening of short lengths of stream channel).

The physical integrity of the aquatic system in the river, including shorelines, banks and bottom configurations, would be beneficially affected by an extensive program of instream restoration.

***Objective 4: "Water quality"***

Assuming the Upper Klamath Lake and scheduled Upper Klamath River TMDLs/WQMPs are implemented, water quality in the planning area would eventually improve.

The difference in water quality between the downstream end of Segment 1 and the area immediately downstream from the powerhouse would be reduced as a result of increased baseflows released from the dam. If the J.C. Boyle facility remains in place, warming rates and DO levels in Segment 1 would continue to be affected by the diversion at the dam. Maximum daily temperatures and warming rates in Segments 2 and 3 would be reduced as a result of increased baseflows.

If the irrigation diversion points on Shovel Creek and Negro Creek are decommissioned, the effects of these withdrawals on warming rates would be eliminated.

This alternative proposes the most comprehensive approach to address critical water quality concerns within the planning area, and thus would be the most likely to result in improved water quality and beneficial uses.

***Objective 5: "Sediment regime"***

If the J.C. Boyle facility remains in place, a system (possibly involving a sediment pass-through around J.C. Boyle reservoir) would be designed to convey sediment past the dam and into the river. This system would likely be capable of restoring (to unimpaired conditions) the character, timing, and duration of bedload transport processes. If the J.C. Boyle facility is removed, the short- and long-term effects on sediment supply and transport would be addressed.

If the J.C. Boyle facility remains in place, it is likely that the timing and duration of sediment entrainment and transport would continue to be affected by peaking operations at the powerhouse. These operations release flows on the order of 3,000 cfs, which are nearly equivalent to the calculated 1.5-year recurrence interval flow in Segment 2. The combination of increased sediment supply and increased sediment storage capacity (near CWD placements, for instance) would serve to reduce the net rate at which sediment is exported from the planning area.

The supply of fine sediment originating from roads and the use of the emergency spillway would be reduced.

Overall, Alternative 3 proposes the most comprehensive approach to sediment management in the planning area, and would be the most likely to restore sediment regimes to within the natural range of variability.

***Objective 6: "Instream flows"***

The BLM proposed instream flow would recommend a "run-of-the-river" flow regime downstream from the powerhouse that mirrors the volume of water flowing into J.C. Boyle Reservoir and minimizes flow fluctuations associated with peaking operations at the powerhouse. This flow regime would be developed in consultation with PacifiCorp and federal, State, and tribal stakeholders during the FERC relicensing process. The flow regime variation would occur within the planning area unimpaired by existing J.C. Boyle hydroelectric facilities.

Flow regulation at Upper Klamath Lake, results in higher and earlier peak flows, decreased summer minimum flows, and greater annual flow variability (BHI 1996). Summer baseflows would be enhanced below the powerhouse, as a result of BLM recommended flows. Peaking flows would be minimized/eliminated in order to provide elevated baseflows during late spring and summer months. The occurrence, duration, and magnitude of channel forming flows would be within the range of natural variation.

Stage fluctuations associated with powerhouse operations would be eliminated. Peaking in the Keno reach could cause occasional stage fluctuations, since peaks generated by irrigation return flows would be passed through J.C. Boyle reservoir.

The streamflow regime proposed in this alternative would result in the greatest benefit to aquatic and riparian habitats in the planning area, and constitute a major improvement over existing conditions.

***Objective 7: "Floodplain inundation and water table elevation"***

Floodplain inundation along the river likely occurs during flows in excess of about 3,300 cfs. Flows at or below this level are likely sufficiently frequent that the shape of the channel has adjusted to convey these flows without inundating the minor floodplains that occur in Segments 1 and 2. The magnitude and frequency of flow fluctuations caused by peaking operations at the powerhouse would be reduced, thereby partially addressing concerns regarding the effects of frequent inundation and exposure of riparian areas.

Irrigation of the meadows in Segment 3 would be adjusted to reduce impacts to fisheries and aquatic resources, and would likely occur earlier in the growing season and deliver less water. This would more closely mimic natural patterns and timing of floodplain inundation.

Actions designed to restore channel processes and floodplain connectivity are proposed for portions of Hayden Creek, Shovel Creek, and other fish-bearing streams. These actions would likely restore connectivity with portions of relic floodplains that are rarely inundated at present. The extent of active floodplains adjacent to these streams would be greater than in other alternatives.

Current water table elevations in upland wet meadows are sufficient to support riparian vegetation communities. Human modifications to flow paths that affect the extent of inundation in some areas would be addressed in this alternative. Upslope treatments could increase the amount of water available in numerous wet meadows.

Overall, the processes driving floodplain inundation and water table elevation would be maintained and restored, and the intent of this objective would be met.

***Objective 8: "Plant communities"***

The effects of the J.C. Boyle hydroelectric facility on the hydrologic and geomorphic processes that influence the extent and character or riparian vegetation communities would be reduced or mitigated. Regardless, ramping in Segments 2 and 3 would continue to affect the frequency, timing, and magnitude of flow fluctuations, and would confer a competitive advantage to plant species (such as reed canary grass) that reproduce vegetatively and can tolerate such flow regimes (Conchou and Fustec, 2001). Downstream from the powerhouse, increased baseflows would reduce the magnitude of daily flow fluctuations, thus reducing the lateral extent of the area affected by ramping.

The extent of alluvial surfaces capable of supporting riparian vegetation would increase as a result of active and passive restoration measures.

Other proposed actions in or adjacent to riparian areas (road decommissioning, vegetation treatments, and exclosure construction) would beneficially affect riparian communities along the river and tributary streams.

Overall, this alternative proposes the most extensive program of active and passive restoration of riparian communities.

***Objective 9: "Habitat"***

Alternative 3 is the most aggressive in enhancing riparian areas and upland habitats across the watershed and would protect habitat over an indefinite time period. The proposed vegetation treatments would enhance these habitats to support well-distributed populations of native plant, invertebrate, and vertebrate riparian-dependent species. This alternative would be expected to maintain the objective in the short-term, with application of appropriate BMP's and PDF's and would restore habitat through vegetation recovery over the long-term. This alternative, when compared to all the other alternatives, would be expected to provide the greatest benefit to existing and potential habitats in the planning area.

## *Alternative 4*

***Objective 1: "Watershed and landscape-scale features"***

A moderate level of enhancement of some landscape level features would be focused primarily on forested and upland communities. Reduced fuel loading and increased diversity of terrestrial habitats within the planning area would be expected to have beneficial impacts on the vegetation community and would protect the diversity and complexity of landscape scale features within the canyon in the long term (greater than ten years).

The short term (over the next ten years) risk of catastrophic fire occurring within the planning area would be reduced, due to accelerated rates of fuels management in the canyon. The distribution, diversity, and complexity of the watershed would be protected from extensive stand replacement fires as a result.

The degree of proposed landscape scale treatments would be expected to have an increased recovery over actions proposed in Alternative 1, nearly identical to Alternative 2, and less than those actions proposed in Alternative 3.

***Objective 2: "Spatial and temporal connectivity"***

The lateral connectivity of the river to adjacent riparian areas in Segment 2 and 3 would continue to be adversely affected by flow ramping at the powerhouse. Minimal active restoration efforts would be conducted to increase lateral connectivity of aquatic habitats within the planning area. The lateral connectivity within riparian areas, and of riparian areas to adjacent upland areas, would be improved by road decommissioning and by stream crossing enhancements.

The lateral connectivity of in river habitats would remain impaired under this alternative. Peaking operations at the J.C. Boyle facility would result in daily dewatering of bank habitat. Proposed fish based on BLM water rights claims would reduce the affect of this loss of aquatic habitat by increasing baseflows. However the active channel bank habitats would remain inaccessible during base summer flows. Lateral connectivity along the river in Segment 1 would continue to be impaired by sidecast material and the patchy distribution of riparian vegetation other than reed canary grass.

Road decommissioning or stream crossing enhancement would improve the longitudinal connectivity of riparian areas along some watercourses. Longitudinal connectivity of the Klamath River would be enhanced by increased baseflows, which would be expected to reduce the magnitude of thermal gradients near the J.C. Boyle powerhouse.

Longitudinal connectivity for fish species would be improved between the river within the planning area and upstream reaches (including an upstream Key Watershed) by enhancing facilities for upstream passage and increasing the rate of unscreened spill at the J.C. Boyle dam. The presence and operation of hydroelectric facilities would continue to impair longitudinal connectivity between the planning area and adjacent river reaches for most aquatic and riparian dependent species.

Connectivity within the planning area would be enhanced and enhancements in riparian –channel connectivity would occur. However, due to continued peaking the overall benefits of proposed projects may be temporally and spatially limited.

***Objective 3: "Physical integrity"***

Channel configurations in the river would continue to be adversely affected by the presence and operation of the J.C. Boyle facility. The reduced supply of coarse sediment, coupled with the release of peaking flows (including recreation releases in Segment 1), would contribute to channel widening and incision. Proposed site-specific fisheries enhancement projects (including gravel placement and installation of structures) would have a slight beneficial effect on channel processes, but would not address the primary causes of channel instability (a lack of coarse sediment and frequent peaking flows).

The existing condition of the river, which reflects past effects of the J.C. Boyle facility, as well as other past and/or ongoing land use effects (including construction of bridges and irrigation diversions, grazing, and historic log drives), would be addressed by a program of site-specific treatments. The effects of the sidecast in Segment 1 would not be addressed.

Currently degraded habitat conditions in some tributary streams would be addressed, but in a limited fashion that would focus primarily on productivity, rather than channel processes. Depending on how they are implemented, these actions could have either beneficial or detrimental long-term effects on channel integrity. Conditions in other streams would continue to respond to dis-equilibrium between watershed conditions and channel form by widening and incising.

The physical integrity of the aquatic system in the river, including shorelines, banks and bottom configurations, would be slightly restored relative to the current degraded condition. The integrity of tributary stream channels could be maintained, restored, or degraded. Overall, it is likely that existing conditions would be maintained, but not substantially restored.

***Objective 4: "Water quality"***

Assuming the Upper Klamath Lake and scheduled Upper Klamath River TMDLs/WQMPs are implemented, water quality in the planning area would eventually improve.

Except during periods when recreation flows are released from the dam, water quality in the lower portion of Segment 1 would continue to be of a different character than water quality in the rest of the river, and the water quality and temperature gradient that exists at the powerhouse would persist. Warming rates and DO levels in Segment 1 would continue to be affected by the diversion at J.C. Boyle Dam. Maximum daily temperatures and warming rates in Segments 2 and 3 would be reduced as a result of increased baseflows.

No alterations in withdrawals from Shovel and Negro Creeks would be recommended. These diversions likely would continue to have an adverse effect on water temperature in these streams.

Overall, there would be slight improvements in certain water quality parameters, although important water quality concerns (and the effects of altered water quality on beneficial uses) in the planning area would not be comprehensively addressed.

***Objective 5: "Sediment regime"***

The supply of coarse sediment in the river would continue to be reduced by the presence of J.C. Boyle Dam. This alternative proposes to place gravel in certain areas of the river. Although these placements would augment the supply of coarse sediment derived from hillslopes and bank erosion, the total supply of coarse sediment would likely be relatively minor compared to that which is transported in the Keno reach of the river and in Spencer Creek (and is subsequently captured in J.C. Boyle Reservoir).

The timing and duration of sediment entrainment and transport would continue to be affected by peaking operations at the powerhouse. These operations release flows on the order of 3,000 cfs, which are nearly equivalent to the calculated 1.5-year recurrence interval flow in Segment 2. In addition, the release of recreation flows in Segment 1 could lead to increased rates of sediment transport through this reach.

The supply of fine sediment originating from roads and the use of the emergency spillway would be reduced.

Limited restoration of coarse sediment would occur in specific areas, but ongoing effects to coarse sediment supply and transport would not be addressed.

***Objective 6: "Instream flows"***

The proposed instream flow would in part be based on water claims for fisheries and recreational values. Additional increases in baseflow may be recommended as part of FERC relicensing of the Klamath Project. The flow regime that would occur within the planning area, including peaking for power production, would reflect flow patterns that have been occurring since the construction of the J.C. Boyle facility. Proposed peaking events in the bypass reach that do not accelerate erosion of exposed hill slope, and do not mobilize in channel sediments would have minimal impacts on aquatic habitats.

Spatial and temporal distribution of peak, high, and low flows would continue to be altered from unimpaired flows. Flow regulation at Upper Klamath Lake, commingled with the diversion and releases related to hydropower generation

at J.C. Boyle, results in higher and earlier peak flows, decreased summer minimum flows, and greater annual flow variability (BHI 1996). Summer baseflows would be enhanced below the powerhouse, as a result of BLM water claims and FERC baseflow increases, to benefit aquatic species. The duration of peaking flows would be reduced in order to provide elevated baseflows during late spring and summer months. However, the impacts to physical process resulting from increased duration channel forming flows when operating two turbines would be expected to continue.

Stage fluctuations associated with powerhouse operations would be frequent and of relatively high magnitude in this alternative.

The streamflow regime proposed in this alternative would constitute a minor improvement over existing conditions but would while continue to affect channel processes.

***Objective 7: "Floodplain inundation and water table elevation"***

Floodplain inundation along the river likely occurs during flows in excess of about 3,300 cfs. Flows at or below this level are likely sufficiently frequent that the shape of the channel has adjusted to convey these flows without inundating the minor floodplains that occur in Segments 1 and 2. Proposed restoration of channel form in Segment 1 would result in re-creation of area that could be inundated on the west side of the river. The magnitude and frequency of flow fluctuations caused by peaking operations at the powerhouse would be reduced, thereby partially addressing concerns regarding the effects of frequent inundation and exposure of riparian areas. This benefit would be offset somewhat by the implementation of a weekend peaking regime in Segment 1.

Irrigation of the relic floodplains in Segment 3 mimics natural inundation somewhat, though the duration and frequency of inundation during summer and fall months does not reflect natural patterns.

A limited program of actions designed to enhance fish habitat in tributary streams is proposed in this alternative. In the long-term, these streams will continue to adjust to flows and sediment supplied from their upper watersheds, and incipient floodplains will form (at a lower elevation that the relic floodplains). The proposed actions could improve stream channel connectivity with incipient or relic floodplains.

Current water table elevations in upland wet meadows are sufficient to support riparian vegetation communities. Human modifications to flow paths affect the extent of inundation in some areas. Upslope treatments could increase the amount of water available in a few wet meadows.

Overall, the processes driving floodplain inundation and water table elevation would be maintained or, in some areas, restored somewhat.

***Objective 8: "Plant communities"***

The hydrologic and geomorphic processes that influence the extent and character or riparian vegetation communities would continue to be affected by the presence and operation of the J.C. Boyle hydroelectric facility. Ramping in Segments 2 and 3 would continue to affect the frequency, timing, and magnitude of flow fluctuations, and would confer a competitive advantage to plant species (such as reed canary grass) that reproduce vegetatively and can tolerate such flow regimes (Conchou and Fustec, 2001). Downstream from the powerhouse, increased baseflows would reduce the magnitude of daily flow fluctuations, thus reducing the lateral extent of the area affected by ramping. The onset of ramping in Segment 1 could have a detrimental effect on riparian vegetation.

The extent of riparian vegetation along the river would continue to be limited by the lack of alluvial surfaces, due in part to altered sediment regimes (refer to the discussion of Objective 5) and, in Segment 1, the effect of the sidecast material. Irrigated meadows in Segment 3 would continue to support mainly non-native species.

Other proposed actions in or adjacent to riparian areas (recreation developments, road decommissioning, vegetation treatments, and exclosure construction) would have a moderate net beneficial effect on riparian communities along the river and tributary streams (though less so than in Alternatives 2 and 3).

Overall, this alternative proposes a limited program of active and passive restoration in riparian communities, with most of the restoration work occurring adjacent to tributaries and in wet meadows.

***Objective 9: "Habitat"***

Alternative 4 would maintain riparian areas and enhance and maintain upland habitats located throughout the watershed over an indefinite time period. The proposed vegetation treatments would enhance these habitats to support well-distributed populations of native plant, invertebrate, and vertebrate riparian-dependent species. This alternative is expected to maintain the objective in the short-term and would restore habitat through vegetation recovery over the long-term. This alternative, when compared to Alternative 2 would be approximately equal in condition improvements, but would be less than those efforts proposed under Alternative 3.

## Table L-1. Recreation developments within riparian reserves (acres)

| | Alternative 1 | | Alternative 2 | | Alternative 3 | | Alternative 4 | |
|---|---|---|---|---|---|---|---|---|
| | Fish-Bearing Streams | All Other Riparian Features | Fish-Bearing Streams | All Other Riparian Features | Fish-Bearing Streams | All Other Riparian Features | Fish-Bearing Streams | All Other Riparian Features |
| **Segment 1** | | | | | | | | |
| BLM | | 3 | <1 | 3 | | 3 | | 3 |
| PacifiCorp | | | <1 | | <1 | | 1 | |
| **Segment 2** | | | | | | | | |
| BLM | 9 | | 11 | 1 | 2 | 2 | 14 | 1 |
| PacifiCorp | 3 | <1 | 4 | <1 | | | 4 | <1 |
| **Segment 3** | | | | | | | | |
| BLM | | | | | | | <1 | |
| PacifiCorp | 1 | <1 | 1 | 4 | 2 | <1 | 2 | 4 |
| **Total** | 13 | 4 | 17 | 8 | 4 | 6 | 17 | 8 |

## Table L-2. Proposed trails within riparian reserves and riparian corridors (miles)

| | Alternative 1 | | Alternative 2 | | Alternative 3 | | Alternative 4 | |
|---|---|---|---|---|---|---|---|---|
| | Fish-Bearing Streams | All Other Riparian Features | Fish-Bearing Streams | All Other Riparian Features | Fish-Bearing Streams | All Other Riparian Features | Fish-Bearing Streams | All Other Riparian Features |
| **Segment 1** | | | | | | | | |
| New Trail | | 0.1 | 5.1 | 0.3 | | | 5.2 | 0.4 |
| Existing Roadbed | | | | | | | | |
| **Segment 2** | | | | | | | | |
| New Trail | 2.8 | 0.8 | 9.6 | | 5.7 | | 9.8 | |
| Existing Roadbed | 1.4 | | 2.8 | | 3.0 | | 2.6 | |
| **Segment 3** | | | | | | | | |
| New Trail | 0.2 | 0.1 | 1.8 | 0.6 | | | 2.5 | 0.8 |
| Existing Roadbed | | | 0.3 | 0.1 | 0.3 | 0.1 | | 0.1 |
| **Total** | | | | | | | | |
| New Trail | 3.0 | 1.0 | 16.5 | 0.9 | 5.7 | | 17.5 | 1.2 |
| Existing Roadbed | 1.4 | | 3.1 | 0.1 | 3.3 | 0.1 | 2.6 | 0.1 |

**Table L-3a. Proposed/recommended road construction and decommissioning within riparian reserves and riparian corridors, by segment (miles)**

| | Alternative 1 | | Alternative 2 | | Alternative 3 | | Alternative 4 | |
|---|---|---|---|---|---|---|---|---|
| | Fish-Bearing Streams | All Other Riparian Features | Fish-Bearing Streams | All Other Riparian Features | Fish-Bearing Streams | All Other Riparian Features | Fish-Bearing Streams | All Other Riparian Features |
| **Segment 2** | | | | | | | | |
| Construction | <0.1 | 0.1 | 0.1 | <0.1 | | 0.1 | 0.1 | 0.1 |
| Decommissioning | | | <0.1 | 0.1 | <0.1 | <0.1 | <0.1 | |
| Obliteration | 2.6 | 1.0 | 4.4 | 1.3 | 5.6 | 1.5 | 3.1 | 1.1 |
| **Segment 3** | | | | | | | | |
| Construction | | | 0.1 | 0.4 | <0.1 | 0.1 | 0.1 | 0.4 |
| Decommissioning | | | | | <0.1 | 0.6 | | |
| Obliteration | | | 0.4 | 0.1 | 0.6 | 0.1 | 0.1 | 0.1 |
| **Total** [1] | | | | | | | | |
| Construction | <0.1 | 0.1 | 0.2 | 0.4 | <0.1 | 0.2 | 0.2 | 0.5 |
| Decommissioning | | | <0.1 | 0.1 | 0.1 | 0.6 | <0.1 | |
| Obliteration | 2.6 | 1.0 | 4.8 | 1.4 | 6.2 | 1.6 | 3.2 | 1.2 |

[1]Due to rounding, the totals presented in this table may not correspond exactly with other tables.

**Table L-3b. Proposed/recommended road construction and decommissioning within riparian reserves and riparian corridors, by ownership (miles)**

| | Alternative 1 | | Alternative 2 | | Alternative 3 | | Alternative 4 | |
|---|---|---|---|---|---|---|---|---|
| | Fish-Bearing Streams | All Other Riparian Features | Fish-Bearing Streams | All Other Riparian Features | Fish-Bearing Streams | All Other Riparian Features | Fish-Bearing Streams | All Other Riparian Features |
| **BLM** | | | | | | | | |
| Construction | 0.1 | | 0.1 | | | 0.1 | 0.1 | |
| Decommissioning | | | | | | 0.3 | | |
| Obliteration | 2.0 | 0.6 | 2.5 | 0.8 | 3.6 | 0.9 | 2.0 | 0.6 |
| **PacifiCorp** | | | | | | | | |
| Construction | | 0.1 | 0.1 | 0.5 | <0.1 | 0.1 | 0.1 | 0.5 |
| Decommissioning | | | <0.1 | 0.1 | <0.1 | 0.4 | <0.1 | |
| Obliteration | 0.7 | 0.4 | 2.4 | 0.6 | 2.5 | 0.7 | 1.2 | 0.5 |
| **Total** [1] | | | | | | | | |
| Construction | 0.1 | 0.1 | 0.2 | 0.5 | <0.1 | 0.2 | 0.2 | 0.5 |
| Decommissioning | | | <0.1 | 0.1 | <0.1 | 0.7 | <0.1 | |
| Obliteration | 2.7 | 1.0 | 4.9 | 1.4 | 6.1 | 1.6 | 3.2 | 1.1 |

[1]Due to rounding, the totals presented in this table may not correspond exactly with other tables.

## Table L-4a. Proposed/recommended road improvements within riparian reserves and riparian corridors, by segment (miles)

| | Alternative 1 | | Alternative 2 | | Alternative 3 | | Alternative 4 | |
|---|---|---|---|---|---|---|---|---|
| | Fish-Bearing Streams | All Other Riparian Features | Fish-Bearing Streams | All Other Riparian Features | Fish-Bearing Streams | All Other Riparian Features | Fish-Bearing Streams | All Other Riparian Features |
| **Segment 1** | | | | | | | | |
| Spot | | 0.2 | 0.6 | 0.2 | 0.6 | 0.2 | | |
| Contiguous | | | | | | | 0.6 | 0.2 |
| **Segment 2** | | | | | | | | |
| Spot | 0.1 | 1.0 | 2.7 | 1.4 | 0.1 | 0.9 | 0.2 | 0.3 |
| Contiguous | | | 0.8 | 0.2 | | 0.2 | 3.6 | 1.5 |
| **Segment 3** | | | | | | | | |
| Spot | | | 0.6 | <0.1 | 0.1 | <0.1 | 0.6 | <0.1 |
| Contiguous | | | 0.1 | | 0.1 | | 0.1 | |
| **Total** [1] | 0.1 | 1.2 | 4.8 | 1.8 | 0.9 | 1.4 | 5.1 | 2.0 |

[1]Due to rounding, the totals presented in this table may not correspond exactly with other tables.

## Table L-4b. Proposed/recommended road improvements within riparian reserves and riparian corridors, by ownership (miles)

| | Alternative 1 | | Alternative 2 | | Alternative 3 | | Alternative 4 | |
|---|---|---|---|---|---|---|---|---|
| | Fish-Bearing Streams | All Other Riparian Features | Fish-Bearing Streams | All Other Riparian Features | Fish-Bearing Streams | All Other Riparian Features | Fish-Bearing Streams | All Other Riparian Features |
| **BLM** | | | | | | | | |
| Spot | 0.1 | 0.7 | 3.3 | 1.1 | 0.7 | 0.7 | 0.2 | 0.2 |
| Contiguous | | | 0.7 | 0.1 | | 0.1 | 4.1 | 1.2 |
| **PacifiCorp** | | | | | | | | |
| Spot | | 0.4 | 0.6 | 0.5 | 0.1 | 0.5 | 0.6 | 0.1 |
| Contiguous | | | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.5 |
| **Total** [1] | 0.1 | 1.8 | 4.7 | 1.8 | 0.9 | 1.4 | 5.0 | 2.0 |

[1]Due to rounding, the totals presented in this table may not correspond exactly with other tables.

**Table L-5. Summary of road status[1] designations for roads within riparian reserves and riparian corridors, by segment (in miles)**

| | Alternative 1 | | Alternative 2 | | Alternative 3 | | Alternative 4 | |
|---|---|---|---|---|---|---|---|---|
| | Fish-Bearing Streams | All Other Riparian Features | Fish-Bearing Streams | All Other Riparian Features | Fish-Bearing Streams | All Other Riparian Features | Fish-Bearing Streams | All Other Riparian Features |
| **Segment 1** | | | | | | | | |
| Open | 2.9 | 0.4 | 2.7 | 0.3 | 1.0 | 0.2 | 2.7 | 0.4 |
| Admin. Use | | | 0.2 | 0.1 | 1.9 | 0.2 | 0.2 | |
| **Segment 2** | | | | | | | | |
| Open | 6.6 | 3.8 | 5.1 | 3.4 | 0.5 | 1.0 | 5.1 | 5.2 |
| Seasonal Closure | 0.7 | 1.1 | 0.5 | 0.7 | 3.1 | 2.9 | 1.0 | 0.1 |
| Admin. Use | 0.4 | 0.8 | 0.4 | 0.8 | 1.1 | 0.9 | 1.2 | |
| **Segment 3** [2] | | | | | | | | |
| Open | 2.7 | 2.5 | 2.9 | 2.8 | 2.5 | 3.1 | 3.4 | 2.8 |
| Seasonal Closure | | | | | | | 0.3 | 0.2 |
| Admin. Use | 2.9 | 2.6 | 2.5 | 2.6 | 2.5 | 2.0 | 2.0 | 2.4 |
| **Total** | | | | | | | | |
| Open | 12.2 | 6.7 | 10.7 | 6.5 | 4.0 | 4.3 | 11.2 | 8.4 |
| Seasonal Closure | 0.7 | 1.1 | 0.5 | 0.7 | 3.1 | 2.9 | 1.3 | 0.3 |
| Admin. Use | 3.3 | 3.4 | 3.1 | 3.5 | 5.5 | 3.1 | 3.4 | 2.4 |

[1] This table refers only to those roads that are open to public and/or administrative access for at least part of each year.
[2] With the exception of Topsy Road, roads on non-PacifiCorp private land in Segment 3 were assumed to be closed to use by the general public.

**Table L-6. Proposed/recommended vegetation treatments within riparian reserves and riparian corridors (acres).**

| | Alternative 1 | | Alternative 2 | | Alternative 3 | | Alternative 4 | |
|---|---|---|---|---|---|---|---|---|
| | Fish-Bearing Streams | All Other Riparian Features | Fish-Bearing Streams | All Other Riparian Features | Fish-Bearing Streams | All Other Riparian Features | Fish-Bearing Streams | All Other Riparian Features |
| **BLM** | | | | | | | | |
| Forest/Woodland | 88 | 80 | 331 | 156 | 389 | 213 | 331 | 156 |
| Dry Meadow/Shrub | 2 | 32 | 32 | 102 | 47 | 117 | 32 | 115 |
| Riparian | 1 | 6 | 16 | 14 | 28 | 17 | 3 | 6 |
| **PacifiCorp** | | | | | | | | |
| Forest/Woodland | | 1 | 35 | 115 | 47 | 183 | 35 | 138 |
| Dry Meadow/Shrub | | | 25 | 37 | 30 | 112 | 31 | 83 |
| Riparian/Irrigated | 3 | 8 | 287 | 223 | 316 | 249 | 12 | 10 |
| **USFS** | | | | | | | | |
| Forest/Woodland | | | | | | 6 | | |
| Riparian/Irrigated | | | | | | 2 | | |
| **Private** | | | | | | | | |
| Riparian | | | | | 3 | 2 | | |
| **Total** | | | | | | | | |
| Forest/Woodland | 88 | 81 | 367 | 270 | 436 | 403 | 367 | 294 |
| Dry Meadow/Shrub | 2 | 32 | 57 | 139 | 76 | 229 | 62 | 198 |
| Riparian/Irrigated | 4 | 14 | 303 | 237 | 344 | 269 | 14 | 16 |
| **Grand Total** | 94 | 127 | 727 | 646 | 856 | 901 | 443 | 508 |

**Table L-7. Effects[1] on Aquatic Conservation Strategy Objectives**

| ACS Objective | Alternative 1 | Alternative 2 | Alternative 3 | Alternative 4 |
|---|---|---|---|---|
| 1 | + | ++ | +++ | ++ |
| 2 | + | ++ | +++ | ++ |
| 3 | 0 | ++ | +++ | 0 |
| 4 | + | ++ | ++ | + |
| 5 | 0 | ++ | +++ | + |
| 6 | + | ++ | +++ | + |
| 7 | 0 | ++ | +++ | + |
| 8 | 0 | ++ | +++ | + |
| 9 | + | ++ | +++ | ++ |

[1] The relative cumulative effect of the proposed alternatives on the nine ACS objectives is as follows:
"0" indicates that the objective would be maintained,
"+" indicates a slight degree of restoration,
"++" indicates a moderate degree of restoration, and
"+++" indicates an extensive degree of restoration.

# Appendix M – Monitoring Plan

# Introduction

## Purpose and Need

Regulations require the BLM to monitor land use plan decisions (43 CFR 1610.4-9) and to adopt a monitoring program for any mitigation incorporated into decisions based on environmental impact statements (40 CFR 1505.2[c]). In addition, protection and enhancement of outstandingly remarkable river values is a mandate of the Wild and Scenic Rivers Act. In order to verify the trend of river resource conditions and to guide future management decisions, it is desirable to systematically sample public land, file the data in an organized fashion, and provide for periodic evaluation of the information obtained. This monitoring plan will assist in the scheduling, budgeting, and reporting of the monitoring process.

## Monitoring Area

The area included in this monitoring plan consists of all public land administered by the BLM from rim to rim along the Klamath River mainstem (see Map 1 of the DEIS). Any private lands that were acquired in the future by the BLM would also be included.

## Objectives

The objectives of this monitoring plan are to:

- Provide for systematic evaluation of each mitigation measure incorporated into the Klamath River Management Plan.
- Outline the minimum standards of information needed to satisfy the Clean Water Act and the Endangered Species Act.
- Provide for systematic evaluation of rate of change to ecological and social conditions occurring as a result of human actions.
- Provide a way to anticipate and plan for future funding needs.

## Budget Constraints

It is important to note that the objectives of this monitoring plan are based on the assumption that annual budget allocations will support full implementation of the Klamath River Management Plan. If actual budgets were significantly different from those projected, desired restoration and enhancement activities would necessarily be reduced, along with the monitoring actions that are associated with them. However, systematic monitoring and evaluation would continue at a level commensurate with the management actions that are implemented, and to ensure that the outstandingly remarkable values of the Klamath River are preserved.

# Monitoring Program

## Implementation Monitoring

When determining whether a course of action is having the desired effects, the first step to take is implementation monitoring. This type of monitoring answers the question: "Were the actions detailed in the Record of Decision accomplished as designed?" Implementation monitoring will be conducted on each mitigation measure incorporated into the Klamath River Management Plan, and disclosure of accomplished actions will be documented in achievement reports. For many mitigation measures, such as standard Best Management Practices, the only monitoring necessary would be implementation monitoring.

## Effectiveness Monitoring

If more monitoring information is desired, the second phase of monitoring is to determine whether the actions documented in the implementation phase of monitoring are having any effect. This phase answers the question: "Did the actions accomplished meet the objectives in the Record of Decision?" Thus, effectiveness monitoring includes obtaining field observations that meet approved protocol, and evaluating the data gathered to determine whether conditions remain within the bounds and intent of Plan direction.

## Validation Monitoring

The validation phase of monitoring seeks to resolve whether the course of action is having the desired effects. Validation answers the question: "Were the initial assumptions used to develop the Klamath River Management Plan correct?" The validation phase also forms the background for adaptive management, and would become the initial data set for the next round of decision making.

# Monitoring Actions

## A. Cultural Resources

**Monitoring Action (Validation):** Human pressure on cultural sites monitoring.
**Objective:** Analysis of and monitoring of human pressure on cultural sites.
**History:** Increased human usage in an area increases impacts to cultural resources.
**Site Selection:** Chose three sites located in or adjacent to popular recreation areas, three sites located in areas of mid-range usage, and three sites in areas of little to no use. The sites that are chosen need to be of similar site types and should be dispersed relatively evenly throughout the three river segments.
**Frequency:** The sites should be checked every fall at the end of the height of recreation use in the canyon.
**Methods:** A form would be developed to describe observations upon visits and photo points would be established. The first visit will establish the baseline data from which future observations will be compared.
**Deviations from Standard Methodology:** No standard methodology exists at present.
**Responsibility:** KFRA Cultural Resource Management personnel.

**Monitoring Action (Effectiveness and Validation):** Site Preservation Treatment Monitoring
**Objective:** Review the effectiveness of implemented site protection measures.
**History:** Stabilization, rehabilitation, and other preservation efforts are suggested in the Klamath River Management Plan. Many of the preservation treatments, especially the historic, are designed to reduce erosional deterioration. These treatments are not mitigation actions tied to ground disturbing projects. Mitigation actions tied to ground disturbing projects would be monitored in a separate study, whereas this study would focus on preservation actions not tied to ground disturbing projects.
**Site Selection:** All the sites that receive preservation treatment within the selected alternative.
**Frequency:** Each site would be checked once a year, preferably in early summer to assess winter weather related damage. This annual monitoring effort would last for the life of the plan.
**Methods:** The site would be visited and a form would be developed to record observations. If damage is present, or evidence that the treatment is showing signs of ineffectiveness, then a photograph would be required to show the ineffective or damage areas. Photos of the treatment areas would be taken before and after treatment implementation, which would serve as the baseline data from which future observations would be compared.
**Deviations from Standard Methodology:** No standard methodology exists at present.
**Responsibility:** Primary responsibility would be on KFRA Cultural Resource Management personnel. However, this task could be performed by anyone visiting the area.

**Monitoring Action (Implementation and Effectiveness):** Mitigation monitoring.
**Objective:** Monitor mitigation efforts. Ensure that cultural resources are being addressed in action pre-planning processes. Ensure that survey protocols are being followed prior to action implementation and that cultural sites (including religious and traditional use areas) are being adequately protected.
**History:** Regulations require a responsible and good faith effort to identify cultural properties and take into account any effect an undertaking may have on those resources. (Section 106 and Section 110(a)(2)(E)of the National Historic Preservation Act (NHPA) and 36 CFR Part 80)
**Site Selection:** The entire Klamath River management planning area.

**Frequency:** Once a year in early spring. This way actions that were implemented the year before could be checked before the rush of the field season begins. This annual monitoring effort would last for the life of the plan.
**Methods:** Document baseline data from all known sites within the management planning area prior to implementation of study. Review all action proposals within and adjacent to cultural resource sites to determine if the effect of the action on those resources were considered. If those resources were considered and mitigation occurred, then ground truth the mitigation to ensure that it was implemented. While in the field, a specially designed form would be completed to document the visit and any subsequent observations.
**Deviations from Standard Methodology:** No standard methodology exists at present.
**Responsibility:** Primary responsibility would be on KFRA Cultural Resource Management personnel.

**Monitoring Action (Implementation):** Native American consultation and coordination monitoring.
**Objective:** To ensure that the BLM is making an effort to work with Native Americans and ensure that Native Americans have access to culturally important areas.
**History:** Since the passage of the Native American Graves Protection and Repatriation Act in 1990, the BLM has been directed to establish government-to-government relations with tribes (Executive Memorandum of April 29, 1994; Executive Order 13084 of May 14, 1998; and BLM Manual Handbook H-8160-1).
**Site Selection:** The entire Klamath River management planning area.
**Frequency:** Annually, primarily in the winter. This effort would last for the life of the plan.
**Methods:** Review documentation regarding action decisions to ensure that Native American are consulted prior to action implementations.
**Deviations from Standard Methodology:** No standard methodology exists at present.
**Responsibility:** Primary responsibility would be on KFRA Cultural Resource Management personnel.

## B. Fire and Fuels

**Monitoring Action (Effectiveness):** Measuring the reduction of ladder fuels in treated forest types through photo points.
**Objective:** To determine the effect of fuels treatment projects on potential for stand-destroying crown fires.
**History:** This is a new study.
**Site Selection:** Same photo points as in vegetation monitoring, number depends on alternative chosen.
**Frequency:** Initial data collection would precede vegetative treatments; then photos would be taken in the first, fifth, and tenth years after implementation. Photo monitoring would then continue at ten-year intervals.
**Methods:** Standard methods for photo monitoring points would be used.
**Deviations from Standard Methodology:** Standard methodology will be used.

**Monitoring Action (Effectiveness):** Measuring the reduction of ladder fuels in treated forest types through stand exams.
**Objective:** To determine the effect of fuels treatment projects on potential for stand destroying crown fires.
**History:** Silvicultural exams in treatment areas are conducted across the resource area.
**Site Selection:** Sample plots for measurement will be the same as in vegetation monitoring.
**Frequency:** Initial data collection would precede vegetative treatments; post-treatment data would be collected in the first fifth, and tenth years after implementation.
**Methods:** Standard methods for silvicultural exams would be used.
**Deviations from Standard Methodology:** Standard methodology will be used.

## C. Fish Resources

**Monitoring Action (Effectiveness):** Upper Klamath River Spawning Surveys
**Objective:** Document changes in spawning behavior in the Upper Klamath River. Did spawning of suckers and or trout increase as is relates to flow, sediment, and temperature alterations?
**History:** Limited knowledge exists on trout or sucker spawning in the Planning area. Flow regimes may be affecting the spawning behavior of Lost River and shortnose suckers in the Klamath River (Salt Caves 1987). Temperature may also serve as an important stimulus for spawning behavior in sucker species (Perkins et al 2000). The entrainment of sediment within the reservoirs of Upper Klamath River has altered gravel distribution and abundance. Lost River and shortnose suckers appear to show a gravel preference as spawning substrate (Buettner and Scoppettone 1990). Spawning gravels for redband trout is limited within the main channel of the Klamath River (Salt Caves 1986). The proposed actions within the River Plan would alter flow regimes, temperature impacts, and sediment regimes within the

Planning area. Efforts to determine the effectiveness of these projects should be based on behavioral indications of success in fish species, i.e. occurrence of spawning may be one indicator.
**Site Selection:** Based on Physical Habitat Survey and anecdotal indications of preferred spawning areas. Stratify river and tributaries based on Rosgen type and other physical features (such as the powerhouse) in order to develop distribution and relative occurrence of spawning behavior across the full planning area.
**Frequency:** Annual efforts should be made prior and post project implementation in order to determine occurrence. For stream spawning populations suckers begin their spawning migration in late February, March, or early April depending on peak flows with spawning activity continuing well into May (Stubbs and White 1993).
**Methods:** ODFW stream survey protocols for salmonids spawning surveys. Redd sampling, using serber sampling gear or freeze cores, may be desirable in order to assess successful spawning and to validate visual observations. All sucker surveys would be conducted according to established protocols (example studies: Buettner and Scoppettone 1990 for spawning activities, Markle and Simon 1993 for larvae presence/absence). Benthic sampling, such as serber sampler, may be necessary for determining occurrence of sucker spawning.
**Deviations from Standard Methodology:** None

**Monitoring Action (Effectiveness):** Upper Klamath River Physical Habitat Surveys
**Objective:** Document changes in the aquatic habitats of the Upper Klamath River. Did we improve baseflow main channel habitats such as pool depths, pool distribution, instream cover, and riparian bank cover? Did we reduce stranding habitats, cutoffs, bank shear?
**History:** Large alterations in daily and weekly flows, especially as it relates to base flow, can highly impact the riparian habitat, and channel geomorphology. The proposed actions within the River Plan would alter flow regimes, sediment regimes, and geomorphic features within the Planning area. Efforts to determine the physical changes and trend in the aquatic habitat within the planning area would be a useful indicator of project effectiveness.
**Site Selection:** All fish bearing reaches within the Planning Area. Baseline surveys of the Klamath River were completed in 1998. Shovel Creek and Hayden Creek below migratory barriers should also be surveyed. Other reaches could be surveyed, as fish distribution within the planning area is refined. Priorities for surveys within tributary reaches should be based on relative size or potential contribution to aquatic habitat and refugia in the planning area.
**Frequency:** Resurvey of aquatic habitats should occur at the conclusion of major river modification projects in order to determine new base lines. Decadal resurvey of the river reach should be conducted in order to determine change and trend (if possible)
**Methods:** Hankin and Reeves modified habitat inventories, such as ODFW Physical Habitat Surveys, or Forest Service Level II Stream Inventories. The habitat surveys should assess current habitat condition such as location and abundance of spawning gravel, rearing habitat, adult cover, migration corridors, and condition of riparian areas.
**Deviations from Standard Methodology:** None

**Monitoring Action (Effectiveness):** Upper Klamath River Fish Migration Surveys
**Objective:** Did passage/movement improve as it relates to flow modifications; attraction flows, temperature adjustments, planning area flow regimes?
**History:** Redband trout passage studies at JC Boyle indicated that in 1959, over 5,500 trout used the ladder (Hanel and Gerlach 1964) while from 1988-91; only 70 to 588 trout used the ladder. This indicates a dramatic decline in fish passage (Hemmingsen et al. 1992). Contemporary passage continues to be less than 10% of that reported one year after project construction of JC Boyle Dam. ODFW in its *Biennial Report on the Status of Wild Fish in Oregon* (1995) noted that inadequate upstream fish passage facilities at JC Boyle Dam is the probable cause of the decline fish numbers from 1959 to 1992. The proposed alteration in attractions flow, changes in flow regimes, and alteration in temperature fluctuation within the planning area would be anticipated to alter migratory behavior of fish populations. Efforts to determine the effectiveness of these projects should be based on behavioral indications of success in fish species, i.e. unimpeded movement between the mainstem Klamath River and spawning/rearing/adult/overwinter habitats.
**Site Selection:** Target locations with known or suspected passage concerns. Locations should include at a minimum sites at JC Boyle Powerhouse, major instream springs, bypass screen outfall, and ladder entrance
**Frequency:** Existing information on fish passage using a mark and recapture methodology (Hemmingsen et al. 1992) with current facilities and operations could serve as baseline. Repeating this study upon implementation of proposed actions would indicate initial changes in migratory behavior. ODFW conducted annual surveys over four years in order to assess conditions. Similar efforts for effectiveness monitoring of BLM actions would be recommended. Using radio-telemetry technologies would require completion of baseline data. Multiple post implementation resurveys using radio-telemetry would be recommended in order to assess migratory trends.
**Methods:** Conduct biological evaluations, such as through radio-telemetry or mark and recapture surveys, to assess migratory characteristics (migration delays, fallback or injury, fishway entrances, ladder configurations, velocity

barriers, temperature barriers, flow attraction concerns, and others). Radio telemetry studies would have the greatest ability to show migratory behavior along the full length of the planning area and would be the recommended method.
**Deviations from Standard Methodology:** Due to the site-specific nature of the proposed modifications additional survey locations, assuming implementation of ODFW methodology may be required in order to determine effects of individual modifications.

**Monitoring Action (Effectiveness/Validation):** Upper Klamath River Fisheries Assessment
**Objective:** Did redband trout age structure or growth rate change within the Klamath River planning area?
**History:** In high-gradient systems trout production can be greatly affected by limited habitat features rather than food supply (Behnke 1992). Oregon Department of Fish and Wildlife fisheries biologists have noted that fish in the planning area appear to be smaller in size on average than fish observed in the Keno reach of the river (Smith 2000, *personal communication*). Excessive recruitment into the population, where young and adult fish are competing for a common food supply results in short-lived, slow-growing individuals and a population whose biomass is tied up in small young fish (Behnke 1992). Based on the population estimates and the existing conditions made up mostly of adult habitat and poor upstream passage at J. C. Boyle Dam the trout population could be exceeding carrying capacity and the additional recruitment of trout to these segments could then affect the trout size/age structure. Proposed actions to alter flow regimes, sediment management, channel profiles, and passage concerns would be expected to alter key habitat quantity, quality and occupancy thus affecting fishery resources. Altering aquatic habitat to enhance the trout bioenergetics (length/weight relationship or age class distribution) would need to be validated in order to determine the effectiveness of proposed projects and support additional instream work.
**Site Selection:** Assuming implementation of a mark and recapture study in order to assess fish passage those sites chose may also function as sites for assess changes in physiological morphological features of native fish fauna.
**Frequency:** Sufficient baseline data from the Keno Reach and the Planning area must be available prior to project implementation. Additional data would need to be collected subsequent to project implementation. Alternative one would have minimal sampling. Alternative two and four would have intermediate levels of resurvey. Alternative three would need to be the most ambitious.
**Methods:** Conduct biological evaluations, bioassesment surveys or stratified electro-shocking surveys, to assess changes in fisheries resources.
**Deviations from Standard Methodology:** None

**Monitoring Action (Effectiveness/Validation):** Upper Klamath River Recreational Creel Survey
**Objective:** Meeting the goals and objective for protecting and enhancing the Recreation and Fisheries ORVs.
**History:** The numerous trout present within the Klamath River, and the ability for Upper Klamath Basin redband trout to attain very large sizes lead in part to the designation of the Keno Dam to Stateline reach as a wild trout management area in Oregon. Oregon Department of Fish and Wildlife fisheries biologists have noted that fish in the analysis area appear to be smaller in size on average than fish observed in the Keno reach of the river (Smith 2000, *personal communication*). The proposed projects were designed to enhance the recreational fishing experience thus providing opportunity to angle for large trout. The effectiveness of these projects to support larger trout sizes need to be validated in order to determine future project implementation.
**Site Selection:** Depends on Creel methodology: Check Stations may include Fish Access #1, Topsy Grade into the canyon, and the Emergency Spill way. Roaming surveys would include pressure counts along the full planning area and subsequent interviews based on dense use locations. Angler Box surveys would have similar stations as described for check stations
**Frequency:** Volunteer angler box surveys would be continuously employed when other methods are not in use. Angler check stations and roaming angler surveying would be targeted for heavy use periods.
**Methods:** Three methods could be employed, individually or combined, in order to assess angler success. One: Angler check stations have been installed in past creel efforts. This type of methodology could be employed to interview angler success when leaving the planning area. Additional stations may need to be employed at other key access points in order to increase accuracy of upstream angling effort, example station location. Two: Roaming angler surveying could be employed in order to gain information of angler success and location of efforts. Roaming surveys could include pressure counts and angler interviews. Three: Angler box surveys may also be employed; locations at key funnel points to enter the canyon, where anglers could volunteer catch information and deposit within the holding boxes provided.
**Deviations from Standard Methodology:** None.

# D. Grazing Management

**Monitoring Action (Implementation):** Grazing use supervision & permit compliance monitoring study.
**Objective:** To monitor permitted grazing use and detect unauthorized use.
**History:** Existing or ongoing management action. Though not formally outlined in Bureau Manuals or Technical References, the need for grazing use compliance checks are implicit in the grazing regulations (43 CFR 4100), TR-4400-2: *Rangeland Monitoring - Actual Use Reporting*, past litigation, common sense, etc.
**Site Selection:** Entire analysis area (Oregon & California) - public and private – depending on alternative selected. Year-to-year site selection is dependent on where (and if) livestock are licensed and grazed.
**Frequency:** Dependent on alternative selected and level of grazing use, but at least twice per year in the analysis area – once in early to mid summer and once in the early fall. More would be done if chronic unauthorized use becomes an issue.
**Methods:** There is no standard methodology. Use supervision is done in a fashion necessary to assure that proper grazing use is being made and is typically done from the ground (on foot, truck, horseback) but may be done from the air (helicopter, fixed wing).
**Deviations from Standard Methodology:** There is no standard methodology to deviate from – just the use of common sense and a method appropriate for the terrain and season.
**Responsibility:** Primarily KFRA range management/monitoring personnel, though this task could be performed by anyone visiting the planning area.

**Monitoring Action (Effectiveness/Validation):** Rangeland trend monitoring
**Objective:** To measure changes in vegetation over the long term.
**History:** Several nested frequency trend studies were established in the Oregon portions of the Klamath Canyon in the early 1990's – 2 on PP&L lands and 1 on the BLM. The BLM study has been re-read once since establishment. The PP&L studies have not been re-read, but resumption of the readings could occur if necessary, depending on which alternative is selected
**Site Selection:** The sites were selected to measure the change of several major grazed vegetation types within the canyon. There are no existing trend studies in the California portion of the planning area. No additional study areas would be selected under any alternative.
**Frequency:** Read every 5 years according the KFRA *Coordinated Monitoring and Evaluation Plan for Grazing Allotments* (located in the KFRA office) and the below listed manuals.
**Methods:** These studies were established and read as outlined in the 1996 Interagency Technical Reference 1734-4: *Sampling Vegetation Attributes* and its predecessor the 1985 Technical Reference 4400-4: *Rangeland Monitoring: Trend Studies*.
**Deviations from Standard Methodology:** Some subtle variations of the process have been made and are outlined in the Edge Creek allotment monitoring file located in the KFRA office.
**Responsibility:** KFRA range management/monitoring personnel

**Monitoring Action (Implementation/Effectiveness):** Utilization measurements within upland and riparian areas via utilization points ("Key Forage Plant Method" on the uplands, "Stubble Height" on riparian) and/or utilization pattern mapping.
**Objective:** To ensure that utilization levels stay within KFRA RMP/ROD (Appendix H) prescribed use levels and to provide specific information into the evaluation of observed condition/trends to help modify/fine-tune future grazing utilization standards.
**History:** The existing studies would continue to be read if grazing continues in the planning area; study elimination, occasional spot checks, or indefinite deferral if grazing is eliminated.
**Site Selection:** The existing utilization points were selected to stratify the grazing use areas to properly portray the grazing use; most are on private lands. No additional study areas would be selected, except on PP&L meadow lands if management responsibility is assumed by the BLM.
**Frequency:** Dependent on the alternative selected and as outlined in the KFRA *Coordinated Monitoring and Evaluation Plan for Grazing Allotments*. If no livestock grazing is authorized, utilization is not necessary.
**Methods:** These will be read as outlined in the 1996 Interagency Technical Reference 1734-3: *Utilization Studies and Residual Measurements* and its predecessor the 1984 Technical Reference 4400-3: *Rangeland Monitoring: Utilization Studies*.
**Deviations from Standard Methodology:** None specifically known or planned.
**Responsibility:** KFRA range management/monitoring personnel

**Monitoring Action (Implementation/Effectiveness/Validation):** Modified Cole Browse (shrub utilization)
**Objective:** To monitor the grazing use of important shrub species – primarily those valuable as winter deer forage (wedgeleaf ceanothus and serviceberry). This study is designed to differentiate between cattle grazing use (fall reading) and deer browsing (subsequent spring reading).
**History:** These studies were established in 1991 because of historical concerns about forage competition between livestock and deer. The studies have not been reread since there has been very little cattle grazing in the area since establishment. No additional studies would be established under any alternative.
**Site Selection:** The studies sites were selected to represent typical use areas for both deer and cattle.
**Frequency:** Dependent on alternative selected and as outlined in the KFRA *Coordinated Monitoring and Evaluation Plan for Grazing Allotments*, but generally no more often that every 5 years. If no livestock grazing is authorized, this study will not be reread.
**Methods:** Studies will be read as outlined in the 1996 Interagency Technical Reference 1734-3: *Utilization Studies and Residual Measurements* and its predecessor the 1984 Technical Reference 4400-3: *Rangeland Monitoring: Utilization Studies*.
**Deviations from Standard Methodology:** The modified method used in the KFRA is explained in a memorandum in the Edge Creek Allotment file, located in the KFRA office.
**Responsibility:** KFRA range management/monitoring personnel

## E. Noxious Weeds

**Monitoring Action (Effectiveness):** Effects of control methods on noxious weed populations and on non-target vegetation.
**Objective:** Document effectiveness of integrated noxious weed control methods.
**History:** This is an expansion of ongoing monitoring in the resource area.
**Site Selection:** Sites will be selected from noxious weed populations documented at treated with Pesticide Application Records submitted by weed treatment crew.
**Frequency:** Sites for monitoring will be selected annually and monitored a sufficient period post-treatment of observe treatment effects.
**Methods:** Qualitative observations on the vigor and appearance of the target species and the surrounding vegetation will be documented on standardized forms.
**Deviations from Standard Methodology:** None.

**Monitoring Action (Effectiveness):** Survey for noxious weeds post-project implementation.
**Objective:** To detect new noxious weed populations established after implementation of ground disturbing activities.
**History:** This type of monitoring is a recommended component of an integrated noxious weed management program.
**Site Selection:** Alternative 2 & 3: Areas where ground disturbing vegetation management actions have been implemented. Alternative 4: Areas adjacent to construction of recreation facilities and adjacent to high use recreation areas.
**Frequency:** Alternatives 2 & 3: Annually for three years after project implementation. Alternative 4: Annually for three years after construction of high use recreation areas. Every three years in areas adjacent to high use recreation areas.
**Methods:** Intuitive controlled survey of entire project area.
**Deviations from Standard Methodology:** None.

## F. Recreation Management

**Monitoring Action (Effectiveness/Validation):** Limits of Acceptable Change (LAC) (Physical, and social component)
**Objective:** To define unique recreation resource values to be maintained and enhanced, and visitor experience types or settings to be managed.
**History:** This study will likely be incorporated into the Recreation Resource Management Plan being developed by PacifiCorp as part of the Klamath Hydroelectric Project (RRMP) re-licensing recreation studies. The completed draft RRMP is scheduled for release by PacifiCorp with the Final License Application in Winter 2004. It is anticipated that the BLM will partner with PacifiCorp on the development and implementation of this study, for including any additional recreation resources, values and settings not covered by the RRMP.
**Site Selection:** Entire analysis area (Oregon & California) - public and private – depending on alternative selected.
**Frequency:** Two levels of periodic surveys and data collection efforts are anticipated: Annual data collection at recreation sites and use areas (during primary use season) using readily available data collected by recreation staff

during normal routine management of recreation resources. In addition, more in-depth recreation surveys and data collection are anticipated to be conducted by PacifiCorp and BLM periodically (10-15 years) or when determined to be needed sooner.
**Methods:** Adapted from Wilderness Campsite Monitoring Methods: A Sourcebook, David N. Cole, USDA FS, Intermountain Research Station, General Technical Report INT-259, April 1989.
**Deviations from Standard Methodology:** After indicators have been selected for the LAC study, monitoring may be refined or modified to meet the needs of the study.
**Responsibility:** Primarily KFRA recreation management/monitoring personnel in conjunction with anticipated PacifiCorp recreation monitoring.

**Monitoring Action (Effectiveness):** Boating use data collection
**Objective:** To determine how the type and amount of boating use changes over time without management intervention, and to determine how the type and amount of boating use is affected by various management actions as identified in the ROD.
**History:** Boating use data has been collected annually since 1981. This will be a continuation of the information that is presently collected.
**Site Selection:** The study will focus on all three segments (Oregon and California), depending on the alternative selected. Primary information will be gathered at the Spring Island launch site and other sites if they are developed. Commercial whitewater outfitters will provide additional supporting data through end-of-season use reports.
**Frequency:** Annually, during the primary float boating season (Memorial Day through mid-September.
**Methods:** Data is collected from both private and commercial users through self-registration at boater registration stations currently located at Spring Island launch and at Frain Ranch. Additional boater registration stations will be installed if new launch sites are developed. River rangers provide compliance checks through launch site visitor contact and river patrols.
**Deviations from Standard Methodology:** Monitoring methods and registration forms may be refined or modified to meet the needs of the study
**Responsibility:** KFRA recreation management/monitoring personnel

## G. Scenic Quality

**Monitoring Action (Effectiveness):** BLM Visual Resource Management (VRM) related to specific projects.
**Objective:** To ensure that projects or management actions maintain or enhance the scenic quality of the landscape in their immediate viewshed.
**History:** This technique has been used with all projects that have ground disturbance or the potential to impact scenic quality/visual resources.
**Site Selection:** For a given project in the planning area, or highly visible from the planning area, key observation points of the project will be established.
**Frequency:** The VRM process is used during the design and planning phase as a mitigation technique, and during construction or project implementation and afterwards to monitor.
**Methods:** From the BLM manual, section H-8400.
**Deviations from standard methodology:** The VRM process will be used at a level commensurate with the size, scope, and potential to cause negative scenic impacts, of the specific project.
**Responsibility:** Led by KFRA Recreation staff, with interdisciplinary assistance.

**Monitoring Action (Effectiveness):** Use BLM VRM to monitor overall scenic quality of the planning area.
**Objective:** To determine if scenic quality of the planning area is being maintained or enhanced on a broad scale, landscape level.
**History:** This will be a new study
**Site Selection:** Key observation points (KOPs) will be established throughout the planning area.
**Frequency:** The initial study will be conducted within 1 year of the approval of the Klamath River Management Plan. Follow up studies will be conducted at a regular interval, every 3-5 years.
**Methods:** From the BLM manual, section H-8400.
Deviations from standard methodology: None
**Responsibility:** Led by KFRA Recreation staff, with interdisciplinary assistance.

## H. Soil Resources

**Monitoring Action (Implementation/Effectiveness/Validation):** Quantitative soil bulk density and soil areal extent monitoring (meets criteria, results from this monitoring effort are used to determine compliance with RMP and regional Standards and Guidelines.
**Objective:** Detect detrimental soil resource changes (i.e. soil compaction), which may result from ground disturbing activities.
**History:** These studies are currently conducted throughout the resource area to comply with RMP and regional standards and guidelines.
**Site Selection:** Monitor 20% of resource area projects that involve ground-disturbing activities. This includes ground-disturbing projects, which may occur within the analysis area. Projects selected for monitoring will be representative of the soil types and projects within the analysis area.
**Frequency:** Prior to and following projects that meet site selection criteria.
**Methods:** Regionally accepted soil monitoring methodology for quantitatively detecting changes in soil bulk density and soil areal extent disturbance.
**Deviations from Standard Methodology:** None.
**Responsibility:** KFRA monitoring personnel.

## I. Special Status Plant Species

**Monitoring Action (Implementation):** Implementation of required surveys.
**Objective:** To insure required surveys are completed such that there is a high probability to detect special status plant species.
**History:** This is an expansion of ongoing monitoring in the resource area.
**Site Selection:** Proposed ground disturbing project areas under all alternatives.
**Frequency:** Prior to implementation of the ground disturbing projects and during the appropriate season for proper identification. May require one or more entries into proposed project areas.
**Methods:** Review of project documentation to determine if the required surveys have been performed and these data have been considered in project design or mitigation.
**Deviations from Standard Methodology:** None.

**Monitoring Action (Effectiveness):** Effects of restoration actions.
**Objective:** To determine the effect of restoration actions on potentially affected populations of special status plants.
**History:** Each monitoring study would new and independent.
**Site Selection:** If a special status plant population would potentially be affected by a restoration action, then a monitoring study would be initiated.
**Frequency:** Initial data collection would precede implementation of the restoration action, then data would be collected annually for the first three years after implementation. Thereafter, data would be collected every three to five years.
**Methods:** Methods would be chosen appropriate to the life form and life history of the subject species using *Measuring & Monitoring Plant Populations*, Elzinga et al. 1998, BLM Technical Reference 1730-1 as a reference.
**Deviations from Standard Methodology:** Methods will vary depending on the life form, life history and/or phrenology of the species, and the size and/or shape of the population.

## J. Vegetation

**Monitoring Action (Effectiveness):** Effects of vegetation management actions.
**Objective:** To determine the effect of vegetative treatments on plant communities and regrowth.
**History:** This is a new study.
**Site Selection:** Random selection of six or more points, depending on alternative chosen.
**Frequency:** Initial data collection would precede vegetative treatments; then photos would be taken in the first, fifth, and tenth years after implementation. Photo monitoring would then continue at ten-year intervals.
**Methods:** Standard methods for photo monitoring points would be used.
**Deviations from Standard Methodology:** Standard methodology will be used.

**Monitoring Action (Validation):** Validation of vegetation management actions.
**Objective:** To determine whether the completed vegetative treatments meet the silvicultural objectives identified for each project area.
**History:** Silvicultural exams in treatment areas are conducted across the resource area.
**Site Selection:** Random selection of approximately 1 plot/10 acres treated.
**Frequency:** Initial data collection would precede vegetative treatments; post-treatment data would be collected in the first year after implementation.
**Methods:** Standard methods for silvicultural exams would be used.
**Deviations from Standard Methodology:** Standard methodology will be used.

**Monitoring Action (Effectiveness):** Assessment of riparian plant community composition and condition.
**Objective:** Determine the effects of management actions on the distribution, composition, and condition of riparian vegetation communities. Over time, determine the trend of these parameters.
**History:** Riparian monitoring occurs throughout the resource area as a component of the range monitoring program.
**Site Selection:** A series of representative riparian areas along the river (approximately 6 sites), tributary streams (approximately 2 sites each along Hayden and Shovel Creeks), and upland wet meadows (Exclosure, Frain, and Rock Creek meadows) will be selected as long-term monitoring sites.
**Frequency:** These sites will be monitored every three years to determine trends and condition.
**Methods:** BLM monitoring protocols described in Myers (1989), Cagney (1993), and Winward (2000) will be used to develop site-specific methodologies. Sampling will consist of a combination of Greenline surveys, transects and plots, and/or photo points. In forested riparian communities along Shovel Creek, stand exams may be used rather than riparian monitoring methods. Periodic Proper Functioning Condition surveys may be used to efficiently expand monitoring efforts to cover larger areas.
**Deviations from Standard Methodology:** In general, the accepted methodology will not be altered. Site- or project-specific concerns may lead to minor adjustments in sample design or monitoring methods.
**Responsibility:** KFRA and PacifiCorp personnel.

## K. Watershed Values

**Monitoring Action (Baseline Information):** Multiparameter water quality monitoring.
**Objective:** Assess condition and trends in surface water quality
**History:** Conducted by ODEQ since 1959.
**Site Selection:** Spring Island Boat Launch (downstream from J.C. Boyle Powerhouse)
**Frequency:** Five to seven times per year
**Methods:** Standard ODEQ sampling and analysis protocols.
**Deviations from Standard Methodology:** None.
**Responsibility:** It is assumed that ODEQ personnel will continue to periodically conduct water quality sampling.

**Monitoring Action (Effectiveness):** Monitoring of OHV use in wet meadows and riparian areas.
**Objective:** Determine the extent of damage caused by unauthorized OHV use and the effectiveness of proposed exclosures and road management actions.
**History:** New monitoring effort
**Site Selection:** All wet meadows or riparian areas within the planning area
**Frequency:** Whenever BLM rangers or natural resource specialists are in the canyon. In Alternative 4, staff would visit wet meadows twice on an annual basis for the specific purpose of assessing OHV use.
**Methods:** Use of the OHV Observation Report notebook by field-going staff and volunteers will be complemented with occasional visits to wet meadows and riparian areas to determine if OHV use is causing damage to riparian soils and vegetation. If a camera is on hand, photos will be taken.
**Deviations from Standard Methodology:** The Observation Report notebook will be used according to the instructions included within the notebook. A standard form will be created to document impacts to wet meadows and riparian areas.
**Responsibility:** KFRA staff, especially watershed and recreation specialists.

**Monitoring Action (Effectiveness/Validation):** Water temperature monitoring
**Objective:** Measure annual, seasonal, and daily ranges in water temperature, in order to assess water quality, habitat value, and the effects of proposed actions.
**History:** PacifiCorp and BLM have conducted limited water temperature monitoring in the past.

**Site Selection:** Will depend on the alternative. At a minimum, sites will include the upstream and downstream ends of Segment 1, downstream from the powerhouse, at the downstream end of Segment 3, and at the mouth of Shovel Creek. In Alternatives 2 and 3, which have more proposed or recommended changes in flow regimes, more sites would be selected.
**Frequency:** Data will be collected every hour. Temperature loggers will be deployed year round, if feasible. At a minimum, loggers will be deployed during the summer and fall.
**Methods:** Standard ODEQ methodology. Temperature data will be analyzed to determine if management actions are affecting (either beneficially or adversely) compliance with state standards and BLM objectives.
**Deviations from Standard Methodology:** None.
**Responsibility:** KFRA, ODEQ, California SWRCB, and PacifiCorp personnel will cooperate to select sites, deploy and retrieve data loggers, and interpret results.

**Monitoring Action (Effectiveness/Validation):** Macroinvertebrate sampling
**Objective:** Assess macroinvertebrate populations within the river and other fish-bearing streams
**History:** Limited macroinvertebrate sampling has occurred in Hayden Creek in the past.
**Site Selection:** Various sites within the river and other streams.
**Frequency:** Twice a year, every 2 years.
**Methods:** Standard ODEQ methodology. Analysis will be contracted to a qualified lab.
**Deviations from Standard Methodology:** None.
**Responsibility:** KFRA, ODEQ, California SWRCB, and PacifiCorp personnel will cooperate to select sites, collect samples, and interpret results.

**Monitoring Action (Effectiveness/Validation):** Geomorphic response to fluvial restoration projects.
**Objective:** Quantify the nature and extent of channel response to fluvial restoration actions (including implementation of "channel maintenance" flow regimes, gravel augmentation, channel realignment, CWD placement, and removal of old bridge abutments).
**History:** A limited number of cross-section transects have been surveyed in the planning area for the purpose of modeling instream flows to support fisheries. These transects would likely not be adequate to meet the objectives of this monitoring task.
**Site Selection:** This monitoring would only occur if fluvial restoration actions occur, and the scope of the monitoring effort will be related to the scope of the restoration actions. Transects would be located in reaches that either are representative of channel conditions or are selected for instream restoration treatments (including reaches in tributary streams). Representative reaches would be used if the only restoration actions are process-based (i.e., alterations to flow and sediment regimes) (about four representative reaches would be selected, and about six transects would be located in each reach). A series of site-specific transects would be used if the only treatments are feature-based (i.e., channel realignment, CWD placement, etc.). Both representative reaches and site-specific transects may be required if a combination of process-based and feature-based actions is implemented.
**Frequency:** Initial data collection will occur prior to restoration project implementation. Subsequent data collection will occur after the first winter, after the first flood with flows greater than 3,300 cfs, and after subsequent large (approximately, greater than five year recurrence interval) floods (or on a schedule of approximately every 5 years, if large floods do not occur within the first few years of project implementation). Scheduled monitoring will end 10 years after project implementation.
**Methods:** The methods described in Harrelson et al. (1994) will be used to select, monument, and survey transects. Photo points will also be used to document changes in channel form.
**Deviations from Standard Methodology:** None.
**Responsibility:** Design of the monitoring network would be a cooperative effort among stakeholders (KFRA, ODFW, CDFG, PacifiCorp, and others). Funding to support the monitoring program would be derived from stakeholders and/or grants.

**Monitoring Action (Effectiveness):** Tagging and tracking of CWD placements
**Objective:** Determine whether instream CWD placements are functioning as intended. Determine the stability of CWD placements and track movements of placed CWD to determine if recreation opportunities or recreation user safety is affected.
**History:** No monitoring of this type currently occurs on the KFRA.
**Site Selection:** This monitoring would only occur if fluvial restoration actions occur, and the scope of the monitoring effort will be related to the scope of the restoration actions. A representative sample of placed CWD pieces and log jams will be monitored.

**Frequency:** Initial data collection will occur immediately after piece placement. Subsequent data collection will occur after the first winter, after the first flood with flows greater than 3,300 cfs and after subsequent large (approximately, greater than five year recurrence interval floods (or on a schedule of approximately every 5 years, if large floods do not occur within the first few years of project implementation). Scheduled monitoring will end 10 years after project implementation.
**Methods:** Naturally-occurring and placed CWD pieces will be marked in multiple places with metal tags. The characteristics of individual pieces and log jams will be noted. The location of pieces and jams will be recorded with a GPS unit.
**Deviations from Standard Methodology:** No standard methodology exists.
**Responsibility:** Design of the monitoring network would be a cooperative effort among stakeholders (KFRA, ODFW, CDFG, PacifiCorp, and others). Funding to support the monitoring program would be derived from stakeholders and/or grants.

**Monitoring Action (Effectiveness):** Assessment of fluvial restoration effects on channel substrate.
**Objective:** Determine the effect of altered flow and sediment regimes on the character of channel substrate.
**History:** No monitoring of this type has occurred within the planning area.
**Site Selection:** A number of gravel bars would be selected for long-term monitoring. Two sites would be located within representative reaches in the planning area (these would be the same as any reaches selected in the "Geomorphic response to fluvial restoration projects" monitoring task). At each site, surface substrate would be sampled with a series of grids on representative geomorphic surfaces. In order to ensure long-term replication, set locations (such as the head, tail, and side) on the selected gravel bars may be used, rather than relying on geomorphic mapping.
**Frequency:** Initial data collection will occur prior to implementation of process-based fluvial restoration programs (this monitoring would only occur in Alternatives 2, 3, and 4). Subsequently, data collection will occur on an annual basis (since flows capable of entraining and transporting gravel likely will occur on an annual basis). Scheduled monitoring will end 10 years after project implementation.
**Methods:** Sampling protocols described in Bunte and Abt (2001) would be utilized.
**Deviations from Standard Methodology:** The location of grid sampling areas on selected gravel bars may be based on site characteristics rather than geomorphic mapping.
**Responsibility:** Design of the monitoring network would be a cooperative effort among stakeholders (KFRA, ODFW, CDFG, PacifiCorp, and others). Funding to support the monitoring program would be derived from stakeholders and/or grants.

**Monitoring Action (Effectiveness):** Measurement of water table depths and soil moisture in Segment 3 irrigated meadows.
**Objective:** To determine the effect on water table depths of recommended alterations in patterns and timing of irrigation in the floodplains adjacent to the river in Segment 3. This information will help differentaite the effects of irrigation and natural sub-irrigation from the river, and will help guide the recommended adaptive management strategy for these lands.
**History:** No monitoring of this type currently occurs.
**Site Selection:** Study transects will be located perpendicular to the river. These transects will be located to sample representative irrigation regimes (there are multiple ditches that convey irrigation water, and their management will vary) and soil characteristics.
**Frequency:** Data loggers will be installed to sample water table depths throughout the year. Monitoring will continue for five years following the first adjustment to irrigation management.
**Methods:** An effective method of measuring water table depth involves installing shallow wells (with casings of PVC pipe) and measuring atmospheric pressure (at the bottom of the well) as a surrogate for the height of the overlying water column. The relationship between atmospheric pressure and water table depth would be calibrated with field measurements of water table depth.
**Deviations from Standard Methodology:** No standard methodology exists
**Responsibility:** KFRA and PacifiCorp personnel will cooperate to develop and implement this monitoring task.

## L. Wild Horse Management

**Monitoring Action (Implementation):** Herd Population Census.
**Objective:** To monitor herd population numbers, structure, color, and other attributes as necessary. A "current inventory of the numbers of animals and their area of use" is required by the Wild Horse & Burro regulations (43 CFR 4710.2) for all Herd Areas.

**History:** Existing or ongoing management action necessary to assure that the wild horse population is within the established AML (Appropriate Management Level – 43 CFR 4710.3-1) for the Pokegama Herd Management Area (HMA).
**Site Selection:** Census will be done within the Pokegama HMA and reasonable buffer area outside the established Herd Area boundary.
**Frequency:** Every year at some level sufficient to monitor the herd population level.
**Methods:** Will follow that generally outlined in the Wild Horse & Burro policies and guidance. Though there is no one standard method, census is done primarily from the air (helicopter preferred), though often supplemented with ground counts (truck, on foot, horseback).
**Deviations from Standard Methodology:** No standard methodology to deviate from; acceptable methods used are dependent on terrain, season, personnel, and funding.
**Responsibility:** KFRA range management/wild horse/monitoring personnel

## M. Wildlife

**Eagles**
**Monitoring Action (Effectiveness):** Occupancy and Status
**Objectives:** Determine occupancy and possible changes as a result of project development.
**History:** On-going cooperative study.
**Site selection:** All known sites
**Methods:** Aerial surveys (April and June) with follow-ups by ground observations. Yearly surveys.
**Responsibility:** Oregon State University cooperative study.

**Peregrines**
**Monitoring Action (Effectiveness):** Occupancy and Status
**Objectives:** Determine occupancy and possible changes as a result of project development.
**History:** On-going study.
**Site selection:** All known and potential sites.
**Methods:** Ground observations. Yearly surveys required for first 5 years after de-listing, periodically after that.

**Big Game populations/upland game**
Completed by ODFW and CFG

**Neotrops/landbirds**
**Monitoring Action (Effectiveness):** Frequency/density
**Objectives:** Determine occupancy and possible changes as a result of vegetation project development.
**History:** Follow-up to a current baseline study (on-going cooperative study).
**Site selection:** Counts along established routes.
**Methods:** Point count surveys (April through June), area searches. Develop methodology to monitor special status species.

**Monitoring Action (Effectiveness):** Nest search
**Objectives:** Determine occupancy and possible changes as a result of project development.
**History:** New study
**Site selection:** All habitat types
**Methods:** Ground searches during nesting season (mid-May through July). Each study completed in one year.

**Monitoring Action (Effectiveness):** Mist net stations, point counts, various methods.
**Objectives:** Determine occupancy and possible changes as a result of habitat development.
**History:** On-going cooperative study.
**Site selection:** **E**stablished stations in preferred riparian habitat.
**Methods:** Mist net stations (May through October). Baseline for 5 more years, then 2 consecutive years periodically.

**Herptile studies**
**Monitoring Action (Effectiveness):** Pond turtle populations - frequency
**Objectives:** Determine occupancy and possible populations changes as a result of project development.
**History:** New trend study
**Site selection:** Individual counts along river.

**Methods:** Area searches or timed searches during routine river patrols or separate float trips

**Monitoring Action (Effectiveness):** Area search, drift fences, various methods.
**Objectives:** Determine occupancy and possible changes as a result of project development.
**History:** Currently a cooperative study.
**Site selection:** Habitat areas or spring sites.
**Methods:** Area searches constrained by time or area, aquatic surveys, and develop methodology to monitor special status species.

**Bats**
See cave management plan

## Table M-1. Monitoring actions by resource of concern

**CULTURAL RESOURCES**

**Monitoring action:** *(Validation) for human pressure on cultural sites*
**Objective:** Analysis of and monitoring of human pressure on cultural sites.

**Frequency:** The sites should be checked every fall at the end of the height of recreation use in the canyon.
**Methods:** A form would be developed to describe observations upon visits and photo points would be established. The first visit will establish the baseline data from which future observations will be compared.

**History:** Increased human usage in an area increases impacts to cultural resources.

**Deviations from standard methodology:** No standard methodology exists at present.

**Site selection:** Chose three sites located in or adjacent to popular recreation areas, three sites located in areas of mid-range usage, and three sites in areas of little to no use. The sites that are chosen need to be of similar site types and should be dispersed relatively evenly throughout the three river segments.

**Responsibility:** KFRA Cultural Resource Management personnel.

**Monitoring action:** *(Effectiveness and validation) for site preservation treatment*

**Frequency: Frequency:** Each site would be checked once a year, preferably in early summer to assess winter weather related damage. This annual monitoring effort would last for the life of the plan.

**Objective:** Review the effectiveness of implemented site protection measures.

**Methods:** The site would be visited and a form would be developed to record observations. If damage is present, or evidence that the treatment is showing signs of ineffectiveness, then a photograph would be required to show the ineffective or damage areas. Photos of the treatment areas would be taken before and after treatment implementation, which would serve as the baseline data from which future observations would be compared.

**History:** Stabilization, rehabilitation, and other preservation efforts are suggested in the Klamath River Management Plan. Many of the preservation treatments, especially the historic, are designed to reduce erosional deterioration. These treatments are not mitigation actions tied to ground disturbing projects. Mitigation actions tied to ground disturbing projects would be monitored in a separate study, whereas this study would focus on preservation actions not tied to ground disturbing projects.

**Deviations from standard methodology:** No standard methodology exists at present.

**Site selection:** All the sites that receive preservation treatment within the selected alternative.

**Responsibility:** Primary responsibility would be on KFRA Cultural Resource Management personnel. However, this task could be performed by anyone visiting the area.

**Monitoring action:** *(Implementation and Effectiveness) for mitigation*

**Frequency:** Once a year in early spring. This way actions that were implemented the year before could be checked before the rush of the field season begins. This annual monitoring effort would last for the life of the plan.

**Objective:** Monitor mitigation efforts. Ensure that cultural resources are being addressed in action pre-planning processes. Ensure that survey protocols are being followed prior to action implementation and that cultural sites (including religious and traditional use areas) are being adequately protected.

**Methods:** Document baseline data from all known sites within the management planning area prior to implementation of study. Review all action proposals within and adjacent to cultural resource sites to determine if the effect of the action on those resources were considered. If those resources were considered and mitigation occurred, then ground truth the mitigation to ensure that it was implemented. While in the field, a specially designed form would be completed to document the visit and any subsequent observations.

**History:** Regulations require a responsible and good faith effort to identify cultural properties and take into account any effect an undertaking may have on those resources. (Section 106 and Section 110(a)(2)(E)of the National Historic Preservation Act (NHPA) and 36 CFR Part 80)

**Deviations from standard methodology:** No standard methodology exists at present.

**Site selection:** The entire Klamath River management planning area.

**Responsibility:** Primary responsibility would be on KFRA Cultural Resource Management personnel.

**Monitoring action**: *(Implementation) for Native American consultation and coordination.*

**Frequency:** Annually, primarily in the winter. This effort would last for the life of the plan.

**Objective:** To ensure that the BLM is making an effort to work with Native Americans and ensure that Native Americans have access to culturally important areas.

**Methods:** Review documentation regarding action decisions to ensure that Native American are consulted prior to action implementations.

**History:** Since the passage of the Native American Graves Protection and Repatriation Act in 1990, the BLM has been directed to establish government-to-government relations with tribes (Executive Memorandum of April 29, 1994; Executive Order 13084 of May 14, 1998; and BLM Manual Handbook H-8160-1).

**Deviations from standard methodology:** No standard methodology exists at present.

**Site selection:** The entire Klamath River management planning area.

**Responsibility:** Primary responsibility would be on KFRA Cultural Resource Management personnel.

**FIRE AND FUELS**

**Monitoring action***: (Effectiveness) for measuring the reduction of ladder fuels in treated forest types through photo points.*

**Frequency:** Initial data collection would precede vegetative treatments; then photos would be taken in the first, fifth, and tenth years after implementation. Photo monitoring would then continue at ten-year intervals.

**Objective:** To determine the effect of fuels treatment projects on potential for stand-destroying crown fires.

**Methods:** Standard methods for photo monitoring points would be used.

**History:** This is a new study.

**Deviations from standard methodology:** Standard methodology will be used.

**Site selection:** Same photo points as in vegetation monitoring, number depends on alternative chosen.

**Responsibility:**

**Monitoring action***: (Effectiveness) for measuring the reduction of ladder fuels in treated forest types through stand exams.*

**Frequency:** Initial data collection would precede vegetative treatments; post-treatment data would be collected in the first fifth, and tenth years after implementation.

**Objective:** To determine the effect of fuels treatment projects on potential for stand destroying crown fires.

**Methods:** Standard methods for silvicultural exams would be used.

**History:** Silvicultural exams in treatment areas are conducted across the resource area.
**Site selection:** Sample plots for measurement will be the same as in vegetation monitoring.

**Deviations from standard methodology:** Standard methodology will be used.
**Responsibility:**

**FISH RESOURCES**

**Monitoring action:** *(Effectiveness) for upper Klamath River spawning surveys*

**Frequency:** Annual efforts should be made prior and post project implementation in order to determine occurrence. For stream spawning populations suckers begin their spawning migration in late February, March, or early April depending on peak flows with spawning activity continuing well into May (Stubbs and White 1993).

**Objective:** Document changes in spawning behavior in the Upper Klamath River. Did spawning of suckers and or trout increase as is relates to flow, sediment, and temperature alterations?

**Methods:** ODFW stream survey protocols for salmonids spawning surveys. Redd sampling, using serber sampling gear or freeze cores, may be desirable in order to assess successful spawning and to validate visual observations. All sucker surveys would be conducted according to established protocols (example studies: Buettner and Scoppettone 1990 for spawning activities, Markle and Simon 1993 for larvae presence/absence). Benthic sampling, such as serber sampler, may be necessary for determining occurrence of sucker spawning.

**History:** Limited knowledge exists on trout or sucker spawning in the Planning area. Flow regimes may be affecting the spawning behavior of Lost River and shortnose suckers in the Klamath River (Salt Caves 1987). Temperature may also serve as an important stimulus for spawning behavior in sucker species (Perkins et al 2000). The entrainment of sediment within the reservoirs of Upper Klamath River has altered gravel distribution and abundance. Lost River and shortnose suckers appear to show a gravel preference as spawning substrate (Buettner and Scoppettone 1990). Spawning gravels for redband trout is limited within the main channel of the Klamath River (Salt Caves 1986). The proposed actions within the River Plan would alter flow regimes, temperature impacts, and sediment regimes within the Planning area. Efforts to determine the effectiveness of these projects should be based on behavioral indications of success in fish species, i.e. occurrence of spawning may be one indicator.

**Deviations from standard methodology:** None.

**Site selection:** Based on Physical Habitat Survey and anecdotal indications of preferred spawning areas. Stratify river and tributaries based on Rosgen type and other physical features (such as the powerhouse) in order to develop distribution and relative occurrence of spawning behavior across the full planning area.

**Responsibility:**

**Monitoring action:** *(Effectiveness) for upper Klamath River physical habitat surveys*

**Frequency:** Resurvey of aquatic habitats should occur at the conclusion of major river modification projects in order to determine new base lines. Decadal resurvey of the river reach should be conducted in order to determine change and trend (if possible)

**Objective:** Document changes in the aquatic habitats of the Upper Klamath River. Did we improve baseflow main channel habitats such as pool depths, pool distribution, instream cover, and riparian bank cover? Did we reduce stranding habitats, cutoffs, bank shear?

**History:** Large alterations in daily and weekly flows, especially as it relates to base flow, can highly impact the riparian habitat, and channel geomorphology. The proposed actions within the River Plan would alter flow regimes, sediment regimes, and geomorphic features within the Planning area. Efforts to determine the physical changes and trend in the aquatic habitat within the planning area would be a useful indicator of project effectiveness.

**Site selection:** All fish bearing reaches within the Planning Area. Baseline surveys of the Klamath River were completed in 1998. Shovel Creek and Hayden Creek below migratory barriers should also be surveyed. Other reaches could be surveyed, as fish distribution within the planning area is refined. Priorities for surveys within tributary reaches should be based on relative size or potential contribution to aquatic habitat and refugia in the planning area.

**Methods:** Hankin and Reeves modified habitat inventories, such as ODFW Physical Habitat Surveys, or Forest Service Level II Stream Inventories. The habitat surveys should assess current habitat condition such as location and abundance of spawning gravel, rearing habitat, adult cover, migration corridors, and condition of riparian areas.

**Deviations from standard methodology:** None.

**Responsibility:**

**Monitoring action:** *(Effectiveness) for upper Klamath River fish migration*

**Objective:** Did passage/movement improve as it relates to flow modifications; attraction flows, temperature adjustments, planning area flow regimes?

**Frequency:** Existing information on fish passage using a mark and recapture methodology (Hemmingsen et al. 1992) with current facilities and operations could serve as baseline. Repeating this study upon implementation of proposed actions would indicate initial changes in migratory behavior. ODFW conducted annual surveys over four years in order to assess conditions. Similar efforts for effectiveness monitoring of BLM actions would be recommended. Using radio-telemetry technologies would require completion of baseline data. Multiple post implementation resurveys using radio-telemetry would be recommended in order to assess migratory trends.

**Methods:** Conduct biological evaluations, such as through radio-telemetry or mark and recapture surveys, to assess migratory characteristics (migration delays, fallback or injury, fishway entrances, ladder configurations, velocity barriers, temperature barriers, flow attraction concerns, and others). Radio telemetry studies would have the greatest ability to show migratory behavior along the full length of the planning area and would be the recommended method.

**History:** Redband trout passage studies at JC Boyle indicated that in 1959, over 5,500 trout used the ladder (Hanel and Gerlach 1964) while from 1988-91; only 70 to 588 trout used the ladder. This indicates a dramatic decline in fish passage (Hemmingsen et al. 1992). Contemporary passage continues to be less than 10% of that reported one year after project construction of JC Boyle Dam. ODFW in its *Biennial Report on the Status of Wild Fish in Oregon* (1995) noted that inadequate upstream fish passage facilities at JC Boyle Dam is the probable cause of the decline fish numbers from 1959 to 1992. The proposed alteration in attractions flow, changes in flow regimes, and alteration in temperature fluctuation within the planning area would be anticipated to alter migratory behavior of fish populations. Efforts to determine the effectiveness of these projects should be based on behavioral indications of success in fish species, i.e. unimpeded movement between the mainstem Klamath River and spawning/rearing/adult/overwinter habitats.
**Site selection:** Target locations with known or suspected passage concerns. Locations should include at a minimum sites at JC Boyle Powerhouse, major instream springs, bypass screen outfall, and ladder entrance.

**Deviations from standard methodology:** Due to the site-specific nature of the proposed modifications additional survey locations, assuming implementation of ODFW methodology may be required in order to determine effects of individual modifications.

**Responsibility:**

**Monitoring action:** *(Effectiveness/validation) for upper Klamath River fisheries assessment*

**Frequency:** Sufficient baseline data from the Keno Reach and the Planning area must be available prior to project implementation. Additional data would need to be collected subsequent to project implementation. Alternative one would have minimal sampling. Alternative two and four would have intermediate levels of resurvey. Alternative three would need to be the most ambitious.

**Objective:** Did redband trout age structure or growth rate change within the Klamath River planning area?

**History:** In high-gradient systems trout production can be greatly affected by limited habitat features rather than food supply (Behnke 1992). Oregon Department of Fish and Wildlife fisheries biologists have noted that fish in the planning area appear to be smaller in size on average than fish observed in the Keno reach of the river (Smith 2000, *personal communication*). Excessive recruitment into the population, where young and adult fish are competing for a common food supply results in short-lived, slow-growing individuals and a population whose biomass is tied up in small young fish (Behnke 1992). Based on the population estimates and the existing conditions made up mostly of adult habitat and poor upstream passage at J. C. Boyle Dam the trout population could be exceeding carrying capacity and the additional recruitment of trout to these segments could then affect the trout size/age structure. Proposed actions to alter flow regimes, sediment management, channel profiles, and passage concerns would be expected to alter key habitat quantity, quality and occupancy thus affecting fishery resources. Altering aquatic habitat to enhance the trout bioenergetics (length/weight relationship or age class distribution) would need to be validated in order to determine the effectiveness of proposed projects and support additional instream work.

**Methods:** Conduct biological evaluations, bioassesment surveys or stratified electro-shocking surveys, to assess changes in fisheries resources.
**Deviations from standard methodology:** None.

**Site selection:** Assuming implementation of a mark and recapture study in order to assess fish passage those sites chose may also function as sites for assess changes in physiological morphological features of native fish fauna.

**Responsibility:**

**Monitoring action: (***Effectiveness/Validation) for upper Klamath River recreational creel survey*

**Frequency:** Volunteer angler box surveys would be continuously employed when other methods are not in use. Angler check stations and roaming angler surveying would be targeted for heavy use periods.

**Objective:** Meeting the goals and objective for protecting and enhancing the Recreation and Fisheries ORVs.

**Methods:** Three methods could be employed, individually or combined, in order to assess angler success. One: Angler check stations have been installed in past creel efforts. This type of methodology could be employed to interview angler success when leaving the planning area. Additional stations may need to be employed at other key access points in order to increase accuracy of upstream angling effort, example station location. Two: Roaming angler surveying could be employed in order to gain information of angler success and location of efforts. Roaming surveys could include pressure counts and angler interviews. Three: Angler box surveys may also be employed; locations at key funnel points to enter the canyon, where anglers could volunteer catch information and deposit within the holding boxes provided.

**History:** The numerous trout present within the Klamath River, and the ability for Upper Klamath Basin redband trout to attain very large sizes lead in part to the designation of the Keno Dam to Stateline reach as a wild trout management area in Oregon. Oregon Department of Fish and Wildlife fisheries biologists have noted that fish in the analysis area appear to be smaller in size on average than fish observed in the Keno reach of the river (Smith 2000, *personal communication*). The proposed projects were designed to enhance the recreational fishing experience thus providing opportunity to angle for large trout. The effectiveness of these projects to support larger trout sizes need to be validated in order to determine future project implementation.

**Deviations from standard methodology:** None.

**Site selection:** Depends on Creel methodology: Check Stations may include Fish Access #1, Topsy Grade into the canyon, and the Emergency Spill way. Roaming surveys would include pressure counts along the full planning area and subsequent interviews based on dense use locations. Angler Box surveys would have similar stations as described for check stations.

**Responsibility:**

**GRAZING MANAGEMENT**

**Monitoring action:** *(Implementation) for grazing use supervision and permit compliance.*

**Frequency:** Dependent on alternative selected and level of grazing use, but at least twice per year in the analysis area – once in early to mid summer and once in the early fall. More would be done if chronic unauthorized becomes an issue.

**Objective:** To monitor permitted grazing use and detect unauthorized use.

**Methods:** There is no standard methodology. Use supervision is done in a fashion necessary to assure that proper grazing use is being made and is typically done from the ground (on foot, truck, horseback) but may be done from the air (helicopter, fixed wing).

**History:** Existing or ongoing management action. Though not formally outlined in Bureau Manuals or Technical References, the need for grazing use compliance checks are implicit in the grazing regulations (43 CFR 4100), TR-4400-2: *Rangeland Monitoring - Actual Use Reporting*, past litigation, common sense, etc.
**Site selection:** Entire analysis area (Oregon & California) - public and private – depending on alternative selected. Year-to-year site selection is dependent on where (and if) livestock are licensed and grazed.

**Deviations from standard methodology:** There is no standard methodology to deviate from – just the use of common sense and a method appropriate for the terrain and season.

**Responsibility:** Primarily KFRA range management/monitoring personnel, though this task could be performed by anyone visiting the planning area.

**Monitoring action:** *(Effectiveness/validation) for rangeland trend*

**Objective:** To measure changes in vegetation over the long term.

**Frequency:** Read every 5 years according the KFRA *Coordinated Monitoring and Evaluation Plan for Grazing Allotments* (located in the KFRA office) and the below listed manuals.
**Methods:** These studies were established and read as outlined in the 1996 Interagency Technical Reference 1734-4: *Sampling Vegetation Attributes* and its predecessor the 1985 Technical Reference 4400-4: *Rangeland Monitoring: Trend Studies*.

**History:** Several nested frequency trend studies were established in the Oregon portions of the Klamath Canyon in the early 1990's – 2 on PP&L lands and 1 on the BLM. The BLM study has been re-read once since establishment. The PP&L studies have not been re-read, but resumption of the readings could occur if necessary, depending on which alternative is selected.
**Site selection:** The sites were selected to measure the change of several major grazed vegetation types within the canyon. There are no existing trend studies in the California portion of the planning area. No additional study areas would be selected under any alternative.

**Deviations from standard methodology:** Some subtle variations of the process have been made and are outlined in the Edge Creek allotment monitoring file located in the KFRA office.

**Responsibility:** KFRA range management/monitoring personnel.

**Monitoring action:** *(Implementation/effectiveness) for utilization measurements within upland and riparian areas via utilization points ("Key Forage Plant Method" on the uplands, "Stubble Height" on riparian) and/or utilization pattern mapping.*

**Objective:** To ensure that utilization levels stay within KFRA RMP/ROD (Appendix H) prescribed use levels and to provide specific information into the evaluation of observed condition/trends to help modify/fine-tune future grazing utilization standards.
**History:** The existing studies would continue to be read if grazing continues in the planning area; study elimination, occasional spot checks, or indefinite deferral if grazing is eliminated.
**Site selection:** The existing utilization points were selected to stratify the grazing use areas to properly portray the grazing use; most are on private lands. No additional study areas would be selected, except on PP&L meadow lands if management responsibility is assumed by the BLM.

**Frequency:** Dependent on the alternative selected and as outlined in the KFRA *Coordinated Monitoring and Evaluation Plan for Grazing Allotments*. If no livestock grazing is authorized, utilization is not necessary.

**Methods:** These will be read as outlined in the 1996 Interagency Technical Reference 1734-3: *Utilization Studies and Residual Measurements* and its predecessor the 1984 Technical Reference 4400-3: *Rangeland Monitoring: Utilization Studies*.
**Deviations from standard methodology:** None specifically known or planned.

**Responsibility:** KFRA range management/monitoring personnel.

**Monitoring action:** *(Implementation/effectiveness/validation) modified Cole Browse (shrub utilization)*

**Objective:** To monitor the grazing use of important shrub species – primarily those valuable as winter deer forage (wedgeleaf ceanothus and serviceberry). This study is designed to differentiate between cattle grazing use (fall reading) and deer browsing (subsequent spring reading).
**History:** These studies were established in 1991 because of historical concerns about forage competition between livestock and deer. The studies have not been reread since there has been very little cattle grazing in the area since establishment. No additional studies would be established under any alternative.
**Site selection:** The studies sites were selected to represent typical use areas for both deer and cattle.

**Frequency:** Dependent on alternative selected and as outlined in the KFRA *Coordinated Monitoring and Evaluation Plan for Grazing Allotments*, but generally no more often that every 5 years. If no livestock grazing is authorized, this study will not be reread.
**Methods:** Studies will be read as outlined in the 1996 Interagency Technical Reference 1734-3: *Utilization Studies and Residual Measurements* and its predecessor the 1984 Technical Reference 4400-3: *Rangeland Monitoring: Utilization Studies*.
**Deviations from standard methodology:** The modified method used in the KFRA is explained in a memorandum in the Edge Creek Allotment file, located in the KFRA office.

**Responsibility:** KFRA range management/monitoring personnel.

**NOXIOUS WEEDS**

**Monitoring action:** *(Effectiveness) for effects of control methods on noxious weed populations and on non-target vegetation.*
**Objective:** Document effectiveness of integrated noxious weed control methods.

**History:** This is an expansion of ongoing monitoring in the resource area.
**Site selection:** Sites will be selected from noxious weed populations documented at treated with Pesticide Application Records submitted by weed treatment crew.

**Frequency:** Sites for monitoring will be selected annually and monitored a sufficient period post-treatment of observe treatment effects.
**Methods: :** Qualitative observations on the vigor and appearance of the target species and the surrounding vegetation will be documented on standardized forms.
**Deviations from standard methodology:** None.

**Responsibility:**

**Monitoring action:** *(Effectiveness) for survey for noxious weeds post-project implementation.*

**Objective:** To detect new noxious weed populations established after implementation of ground disturbing activities.
**History:** This type of monitoring is a recommended component of an integrated noxious weed management program.
**Site selection:** Alternative 2 & 3: Areas where ground disturbing vegetation management actions have been implemented. Alternative 4: Areas adjacent to construction of recreation facilities and adjacent to high use recreation areas.

**Frequency:** Alternatives 2 & 3: Annually for three years after project implementation. Alternative 4: Annually for three years after construction of high use recreation areas. Every three years in areas adjacent to high use recreation areas.
**Methods:** Intuitive controlled survey of entire project area.
**Deviations from standard methodology:** None.

**Responsibility:**

**RECREATION MANAGEMENT**

**Monitoring action:** *(Effectiveness/Validation) for limits of acceptable change (physical, and social component)*

**Frequency:** Two levels of periodic surveys and data collection efforts are anticipated: Annual data collection at recreation sites and use areas (during primary use season) using readily available data collected by recreation staff during normal routine management of recreation resources. In addition, more in-depth recreation surveys and data collection are anticipated to be conducted by PacifiCorp and BLM periodically (10-15 years) or when determined to be needed sooner.

**Objective:** To define unique recreation resource values to be maintained and enhanced, and visitor experience types or settings to be managed.

**History:** This study will likely be incorporated into the Recreation Resource Management Plan being developed by PacifiCorp as part of the Klamath Hydroelectric Project (RRMP) re-licensing recreation studies. The completed draft RRMP is scheduled for release by PacifiCorp with the Final License Application in Winter 2004. It is anticipated that the BLM will partner with PacifiCorp on the development and implementation of this study, for including any additional recreation resources, values and settings not covered by the RRMP.
**Site selection:** Entire analysis area (Oregon & California) - public and private – depending on alternative selected.

**Methods:** Adapted from Wilderness Campsite Monitoring Methods: A Sourcebook, David N. Cole, USDA FS, Intermountain Research Station, General Technical Report INT-259, April 1989.
**Deviations from standard methodology:** After indicators have been selected for the LAC study, monitoring may be refined or modified to meet the needs of the study.
**Responsibility:** Primarily KFRA recreation management/monitoring personnel in conjunction with anticipated PacifiCorp recreation monitoring.

**Monitoring action:** *(Effectiveness) boating use data collection*

**Objective:** To determine how the type and amount of boating use changes over time without management intervention, and to determine how the type and amount of boating use is affected by various management actions as identified in the ROD.

**History:** Boating use data has been collected annually since 1981. This will be a continuation of the information that is presently collected.
**Site selection:** The study will focus on all three segments (Oregon and California), depending on the alternative selected. Primary information will be gathered at the Spring Island launch site and other sites if they are developed. Commercial whitewater outfitters will provide additional supporting data through end-of-season use reports.

**Responsibility:**

**Frequency:** Annually, during the primary float boating season (Memorial Day through mid-September.
**Methods:** Data is collected from both private and commercial users through self-registration at boater registration stations currently located at Spring Island launch and at Frain Ranch. Additional boater registration stations will be installed if new launch sites are developed. River rangers provide compliance checks through launch site visitor contact and river patrols.
**Deviations from standard methodology: :** Monitoring methods and registration forms may be refined or modified to meet the needs of the study.
**Responsibility:** *KFRA recreation management/monitoring personnel*

**SCENIC QUALITY**

**Monitoring action:** *(Effectiveness) for BLM Visual Resource Management (VRM) related to specific projects.*

**Objective:** To ensure that projects or management actions maintain or enhance the scenic quality of the landscape in their immediate viewshed.
**History:** This technique has been used with all projects that have ground disturbance or the potential to impact scenic quality/visual resources.

**Site selection:** For a given project in the planning area, or highly visible from the planning area, key observation points of the project will be established.

**Frequency:** The VRM process is used during the design and planning phase as a mitigation technique, and during construction or project implementation and afterwards to monitor.
**Methods:** From the BLM manual, section H-8400.

**Deviations from standard methodology: :** The VRM process will be used at a level commensurate with the size, scope, and potential to cause negative scenic impacts, of the specific project.
**Responsibility:** Led by KFRA Recreation staff, with interdisciplinary assistance.

**Monitoring action:** *(Effectiveness) for BLM VRM to monitor overall scenic quality of the planning area.*

**Objective:** To determine if scenic quality of the planning area is being maintained or enhanced on a broad scale, landscape level.

**Frequency:** The initial study will be conducted within 1 year of the approval of the Klamath River Management Plan. Follow up studies will be conducted at a regular interval, every 3-5 years.
**Methods:** From the BLM manual, section H-8400.

**History:** This will be a new study
**Site selection:** Key observation points (KOPs) will be established throughout the planning area.

**Deviations from standard methodology:** None.
**Responsibility:** Led by KFRA Recreation staff, with interdisciplinary assistance.

**SOIL RESOURCES**

**Monitoring action:** (Implementation/effectiveness/validation) for quantitative soil bulk density and soil areal extent (meets criteria, results from this monitoring effort are used to determine compliance with RMP and regional Standards and Guidelines.
**Objective:** Detect detrimental soil resource changes (i.e. soil compaction), which may result from ground disturbing activities.

**History:** These studies are currently conducted throughout the resource area to comply with RMP and regional standards and guidelines.
**Site selection:** Monitor 20% of resource area projects that involve ground-disturbing activities. This includes ground-disturbing projects, which may occur within the analysis area. Projects selected for monitoring will be representative of the soil types and projects within the analysis area.

**Frequency:** Prior to and following projects that meet site selection criteria.

**Methods:** Regionally accepted soil monitoring methodology for quantitatively detecting changes in soil bulk density and soil areal extent disturbance.
**Deviations from standard methodology:** None.

**Responsibility:** KFRA monitoring personnel.

**SPECIAL STATUS PLANT SPECIES**

**Monitoring action:** *(Implementation for implementation of required surveys.*

**Objective:** To insure required surveys are completed such that there is a high probability to detect special status plant species.

**History:** This is an expansion of ongoing monitoring in the resource area.
**Site selection:** Proposed ground disturbing project areas under all alternatives.

**Frequency:** Prior to implementation of the ground disturbing projects and during the appropriate season for proper identification. May require one or more entries into proposed project areas.
**Methods:** Review of project documentation to determine if the required surveys have been performed and these data have been considered in project design or mitigation.
**Deviations from standard methodology:** None.

**Responsibility:**

**Monitoring action:** *(Effectiveness) for effects of restoration actions.*

**Objective:** To determine the effect of restoration actions on potentially affected populations of special status plants.

**History:** Each monitoring study would new and independent.

**Site selection:** If a special status plant population would potentially be affected by a restoration action, then a monitoring study would be initiated.

**Frequency:** Initial data collection would precede implementation of the restoration action, then data would be collected annually for the first three years after implementation. Thereafter, data would be collected every three to five years.
**Methods:** Methods would be chosen appropriate to the life form and life history of the subject species using *Measuring & Monitoring Plant Populations*, Elzinga et al. 1998, BLM Technical Reference 1730-1 as a reference.
**Deviations from standard methodology:** Methods will vary depending on the life form, life history and/or phrenology of the species, and the size and/or shape of the population.
**Responsibility:**

## VEGETATION

**Monitoring action:** *(Effectiveness) for effects of vegetation management actions.*

**Objective:** To determine the effect of vegetative treatments on plant communities and regrowth.
**History:** This is a new study.

**Site selection:** Random selection of six or more points, depending on alternative chosen.

**Frequency: :** Initial data collection would precede vegetative treatments; then photos would be taken in the first, fifth, and tenth years after implementation. Photo monitoring would then continue at ten-year intervals.
**Methods:** Standard methods for photo monitoring points would be used.
**Deviations from standard methodology:** Standard methodology will be used.
**Responsibility:**

**Monitoring action:** (*Validation)for validation of vegetation management actions.*

**Objective:** To determine whether the completed vegetative treatments meet the silvicultural objectives identified for each project area.
**History:** Silvicultural exams in treatment areas are conducted across the resource area.
**Site selection:** Random selection of approximately 1 plot/10 acres treated.

**Frequency:** Initial data collection would precede vegetative treatments; post-treatment data would be collected in the first year after implementation.
**Methods:** Standard methods for silvicultural exams would be used.

**Deviations from standard methodology:** Standard methodology will be used.
**Responsibility:**

## WATERSHED VALUES

**Monitoring action:** *(Baseline Information) for Upper Klamath River Canyon Road Inventory*
**Objective:** Comprehensive and accurate inventory of roads and road conditions
**History:** Completed in summer 2001. Cooperative agreement with PacifiCorp.
**Site selection:** Entire planning area, except for private land in California.

**Frequency:** One time only. Database will be updated as proposed actions are implemented.
**Methods:** Vehicle-based GPS work linked with real-time GIS.
**Deviations from standard methodology:** No standard methodology exists.
**Responsibility:**

**Monitoring action:** *Action (Baseline Information) for multiparameter water quality monitoring.*
**Objective:** Assess condition and trends in surface water quality

**History:** Conducted by ODEQ since 1959.
**Site selection:** Spring Island Boat Launch (downstream from J.C. Boyle Powerhouse)

**Frequency:** Five to seven times per year

**Methods:** Standard ODEQ sampling and analysis protocols.
**Deviations from standard methodology:** None.
**Responsibility:**

**Monitoring action:** *(Effectiveness) for monitoring of OHV use in wet meadows and riparian areas.*
**Objective:** Determine the extent of damage caused by unauthorized OHV use and the effectiveness of proposed exclosures and road management actions.

**History:** New monitoring effort

**Site selection:** All wet meadows or riparian areas within the planning area

**Frequency:** Whenever BLM rangers or natural resource specialists are in the canyon
**Methods:** Use of the OHV Observation Report notebook by field-going staff and volunteers will be complemented with occasional visits to wet meadows and riparian areas to determine if OHV use is causing damage to riparian soils and vegetation. If a camera is on hand, photos will be taken.
**Deviations from standard methodology:** The Observation Report notebook will be used according to the instructions included within the notebook. A standard form will be created to document impacts to wet meadows and riparian areas.
**Responsibility:**

*Monitoring action: (Effectiveness/validation) for water temperature monitoring*

**Objective:** Measure annual, seasonal, and daily ranges in water temperature, in order to assess water quality, habitat value, and the effects of proposed actions.

**History:** PacifiCorp and BLM have conducted limited water temperature monitoring in the past.
**Site selection:** Will depend on the alternative. At a minimum, the upstream and downstream ends of Segment 1, downstream from the powerhouse, at the downstream end of Segment 3, and at the mouth of Shovel Creek. In alternatives 2 and 3, which have more proposed or recommended changes in flow regimes, more sites would be selected.

**Frequency:** Data will be collected every hour. Temperature loggers will be deployed year round, if feasible. At a minimum, loggers will be deployed during the summer and fall.
**Methods: :** Standard ODEQ methodology. Temperature data will be analyzed to determine if management actions are affecting (either beneficially or adversely) compliance with state standards and BLM objectives.
**Deviations from standard methodology:** None.

**Responsibility:**

**Monitoring action:** *(Effectiveness/validation) for macroinvertebrate sampling*
**Objective:** Assess macroinvertebrate populations within the river and other fish-bearing streams
**History:** Limited macroinvertebrate sampling has occurred in Hayden Creek in the past.
**Site selection:** Various sites within the river and other streams.

**Frequency:** Twice a year, every 2 years.

**Methods:** Standard ODEQ methodology. Analysis will be contracted to a qualified lab.
**Deviations from standard methodology:** None.

**Responsibility:**

**Monitoring action:** *(Effectiveness/validation) geomorphic response to fluvial restoration projects.*

**Objective:** . Quantify the nature and extent of channel response to fluvial restoration actions (including implementation of "channel maintenance" flow regimes, gravel augmentation, channel realignment, CWD placement, and removal of old bridge abutments).
**History:** A limited number of cross-section transects have been surveyed in the planning area for the purpose of modeling instream flows to support fisheries. These transects would likely not be adequate to meet the objectives of this monitoring task.
**Site selection:** This monitoring would only occur if fluvial restoration actions occur, and the scope of the monitoring effort will be related to the scope of the restoration actions. Transects would be located in reaches that either are representative of channel conditions or are selected for instream restoration treatments (including reaches in tributary streams). Representative reaches would be used if the only restoration actions are process-based (i.e., alterations to flow and sediment regimes) (about four representative reaches would be selected, and about six transects would be located in each reach). A series of site-specific transects would be used if the only treatments are feature-based (i.e., channel realignment, CWD placement, etc.). Both representative reaches and site-specific transects may be required if a combination of process-based and feature-based actions is implemented.

**Frequency: :** Initial data collection will occur prior to restoration project implementation. Subsequent data collection will occur after the first winter and after large flood events (or on a schedule of approximately every 5 years, if large floods do not occur within the first few years of project implementation). Scheduled monitoring will end 10 years after project implementation.
**Methods:** The methods described in Harrelson et al. (1994) will be used to select, monument, and survey transects. Photo points will also be used to document changes in channel form.

**Deviations from standard methodology:** None.

**Responsibility:**

**Monitoring action***: (Effectiveness) for tagging and tracking of CWD placements*

**Objective:** Determine whether instream CWD placements are functioning as intended. Determine the stability of CWD placements and track movements of placed CWD to determine if recreation opportunities or recreation user safety is affected.

**History:** No monitoring of this type currently occurs on the KFRA.
**Site selection:** A representative sample of placed CWD pieces and log jams will be monitored.

**Frequency:** Initial data collection will occur immediately after piece placement. Subsequent data collection will occur after the first winter and after large flood events (or on a schedule of approximately every 5 years, if large floods do not occur within the first few years of project implementation). Scheduled monitoring will end 10 years after project implementation.
**Methods:** Naturally-occurring and placed CWD pieces will be marked in multiple places with metal tags. The characteristics of individual pieces and log jams will be noted. The location of pieces and jams will be recorded with a GPS unit.
**Deviations from standard methodology:** No standard methodology exists.
**Responsibility:**

**Monitoring action: Action** *(Effectiveness) assessment of fluvial restoration effects on channel substrate.*

**Objective:** Determine the effect of altered flow and sediment regimes on the character of channel substrate.
**History:** No monitoring of this type has occurred within the planning area.

**Site selection:** A number of gravel bars would be selected for long-term monitoring. Two sites would be located within representative reaches in the planning area (these would be the same as any reaches selected in the "Geomorphic response to fluvial restoration projects" monitoring task). At each site, surface substrate would be sampled with a series of grids on representative facies types. In order to ensure long-term replication, set locations (such as the head, tail, and side) on the selected gravel bars may be used, rather than relying on facies mapping.

**Frequency:** Initial data collection will occur prior to implementation of process-based fluvial restoration programs (this monitoring would only occur in alternatives 2, 3, and 4). Subsequent data collection will occur after the first winter and after large flood events (or on a schedule of approximately every 5 years, if large floods do not occur within the first few years of project implementation). Scheduled monitoring will end 10 years after project implementation.
**Methods:** Sampling protocols described in Bunte and Abt (2001) would be utilized.
**Deviations from standard methodology:** The location of grid sampling areas on selected gravel bars may be based on general representativeness rather than facies mapping.
**Responsibility:**

**Monitoring action:** *(Effectiveness) for assessment of riparian plant community composition and condition.*

**Objective:** Determine the effects of management actions on the distribution, composition, and condition of riparian vegetation communities. Over time, determine the trend of these parameters.

**Frequency:** These sites will be monitored every three years to determine trends and condition.

**Methods:** BLM monitoring protocols described in Myers (1989), Cagney (1993), and Winward (2000) will be used to develop site-specific methodologies. Sampling will consist of a combination of Greenline surveys, transects and plots, and/or photo points. In forested riparian communities along Shovel Creek, stand exams may be used rather than riparian monitoring methods. Periodic Proper Functioning Condition surveys may be used to efficiently expand monitoring efforts to cover larger areas.

**History:** Riparian monitoring occurs throughout the resource area as a component of the range monitoring program.

**Site selection:** A series of representative riparian areas along the river (approximately 6 sites), tributary streams (approximately 2 sites each along Hayden and Shovel Creeks), and upland wet meadows (Exclosure, Frain, and Rock Creek meadows) will be selected as long-term monitoring sites.

**Deviations from standard methodology:** In general, the accepted methodology will not be altered. Site- or project-specific concerns, or advancements in the field of soils monitoring, may lead to minor adjustments in sample design or monitoring methods.
**Responsibility:**

**Monitoring action:** *(Effectiveness) for measurement of water table depths and soil moisture in Segment 3 floodplains*
**Objective:** To determine the effect on water table depths of recommended alterations in patterns and timing of irrigation in the floodplains adjacent to the river in Segment 3. This information will help differentiate the effects of irrigation and natural sub-irrigation from the river, and will help guide the recommended adaptive management strategy for these lands.

**History:** No monitoring of this type currently occurs.

**Site selection:** Study transects will be located perpendicular to the river. These transects will be located to sample representative irrigation regimes (there are multiple ditches that convey irrigation water, and their management will vary) and soil characteristics.

**Frequency:** Data loggers will be installed to sample water table depths throughout the year.
**Methods:** An effective method of measuring water table depth involves installing shallow wells (with casings of PVC pipe) and measuring atmospheric pressure (at the bottom of the well) as a surrogate for the height of the overlying water column. The relationship between atmospheric pressure and water table depth would be calibrated with field measurements of water table depth.
**Deviations from standard methodology:**
**No standard metholodogy exists.**
**Responsibility:**

**WILD HORSE MANAGEMENT**

**Monitoring action:** *(Implementation) herd population census.*

**Objective:** To monitor herd population numbers, structure, color, and other attributes as necessary. A "current inventory of the numbers of animals and their area of use" is required by the Wild Horse & Burro regulations (43 CFR 4710.2) for all Herd Areas.
**History:** Existing or ongoing management action necessary to assure that the wild horse population is within the established AML (Appropriate Management Level – 43 CFR 4710.3-1) for the Pokegama Herd Management Area (HMA).
**Site selection:** Census will be done within the Pokegama HMA and reasonable buffer area outside the established Herd Area boundary.

**Frequency:** Every year at some level sufficient to monitor the herd population level.
**Methods:** Will follow that generally outlined in the Wild Horse & Burro policies and guidance. Though there is no one standard method, census is done primarily from the air (helicopter preferred), though often supplemented with ground counts (truck, on foot, horseback).
**Deviations from standard methodology:** No standard methodology to deviate from; acceptable methods used are dependent on terrain, season, personnel, and funding.

**Responsibility:** KFRA range management/wild horse/monitoring personnel

**WILDLIFE**

***Eagles***

**Monitoring action:** *(Effectiveness) occupancy and Status*
**Objective:** Determine occupancy and possible changes as a result of project development.
**History:** On-going cooperative study.
**Site selection:** All known sites

**Frequency:**
**Methods:** Aerial surveys (April and June) with follow ups by ground observations. Yearly surveys.
**Deviations from standard methodology:**
**Responsibility:**

***Peregrines***

**Monitoring action:** *(Effectiveness) occupancy and Status*
**Objective:** Determine occupancy and possible changes as a result of project development.

**Frequency:**
**Methods:** Ground observations. Yearly surveys required for first 5 years after de-listing, periodically after that.

**History:** On-going study.
**Site selection:** All known and potential sites.

***Big Game populations/upland game***

**Monitoring action:** Completed by ODFW and CFG
**Objective:**
**History:**
**Site selection:**

**Deviations from standard methodology:**
**Responsibility:**

**Frequency:**
**Methods:**
**Deviations from standard methodology:**
**Responsibility:**

***Neotrops/ landbirds***

**Monitoring action:** *(Effectiveness) frequency/density*
**Objective:** Determine occupancy and possible changes as a result of project development.

**History:** On-going cooperative study.
**Site selection:** Point counts along established routes.

**Frequency:**
**Methods:** Point count surveys (April through June), area searches, develop methodology to monitor special status species. 3-5 years baseline and then 2 consecutive years of surveys periodically after treatments.
**Deviations from standard methodology:**
**Responsibility:**

**Monitoring action:** *(Effectiveness) nest search*
**Objective:** Determine occupancy and possible changes as a result of project development.
**History:** New study
**Site selection:** All habitat types

**Frequency:**
**Methods:** Ground searches during nesting season (mid-May through July). Each study completed in one year.
**Deviations from standard methodology:**
**Responsibility:**

**Monitoring action:** *(Effectiveness) mist net stations*
**Objective:** Determine occupancy and possible changes as a result of habitat development.

**History:** On-going cooperative study.
**Site selection:** Established stations in preferred riparian habitat.

**Frequency:**
**Methods:** Mist net stations (May through October). Baseline for 5 more years, then 2 consecutive years periodically.
**Deviations from standard methodology:**
**Responsibility:**

***Herpetile studies***

**Monitoring action:** *(Effectiveness) for pond turtle populations - frequency*
**Objective:** Determine occupancy and possible populations changes as a result of project development.
**History:** New trend study
**Site selection:** Individual counts along river.

**Frequency:**

**Methods:** Area searches or timed searches during routine river patrols or separate float trips
**Deviations from standard methodology:**
**Responsibility:**

**Monitoring action:** *(Effectiveness) area search*
**Objective:** Determine occupancy and possible changes as a result of project development.

**History:** Currently a cooperative study.
**Site selection:** Habitat areas or spring sites.

**Frequency:** Currently a cooperative study.
**Methods:** Area searches constrained by time or area, aquatic surveys, and develop methodology to monitor special status species.
**Deviations from standard methodology:**
**Responsibility:**

***Bats***

**Monitoring action:** See cave management plan.
**Objective:**
**History:**
**Site selection:**

**Frequency:**
**Methods:**
**Deviations from standard methodology:**
**Responsibility:**

***Vegetation***

**Monitoring action:** *(Effectiveness) for frequency/density*
**Objective:** Determine occupancy and possible changes as a result of project development.

**Frequency:**
**Methods:** Point count surveys (April through June), area searches. Develop methodology to monitor special status species.

**History:** On-going cooperative study.
**Site selection:** Point counts along established routes.
**Deviations from standard methodology:**
**Responsibility:**

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**Table M-2. Monitoring actions for the Upper Klamath River Management Plan**

| Monitoring activities | Alternative 1 | Alternative 2 | Alternative 3 | Alternative 4 |
|---|---|---|---|---|
| **Cultural Resources** | | | | |
| Human Pressure on Cultural Sites | Not Recommended | Every Year - fall | Not Recommended | Every Year - fall |
| Site Preservation Treatment | Not Recommended | Every Year - spring/early summer | Every Year - spring/early summer | Every Year - spring/early summer |
| Mitigation | Every Year - spring | Every Year - spring | Every Year - spring | Every Year - spring |
| Native American Consultation and coordination | Every Year - winter | Every Year - winter | Every Year - winter | Every Year - winter |
| **Fire and Fuels** | | | | |
| Photo Points | Initial data collection would precede implementation of vegetative treatments. Data would be collected in the first, fifth, and tenth years after implementation. Thereafter, data would be collected every ten years. | | | |
| Stand Exams | Approximately 120 plots per decade | Approximately 450 plots per decade | Approximately 700 plots per decade | Approximately 460 plots per decade |
| **Fish** | | | | |
| Spawning Surveys | N/A | Pre- and post-project winter/spring monitoring-- limited annual effort | Pre- and post-project winter/spring monitoring-- extensive annual effort | Pre- and post-project winter/spring monitoring-- limited annual effort |
| Habitat Surveys | Upon completion of proposed projects and then every decade | | | |
| Migration Surveys | N/A | Pre and post project spring/ summer/ fall monitoring over four years | | |
| Fisheries Assessment | N/A | Pre and post project spring/ summer/ fall monitoring over four years | | |
| Creel Surveys | N/A | Adaptive implementation based on actual use for recreation fishing | | |
| | | Initial survey, pre- and post-project implementation | | |
| **Grazing** | | | | |
| Use Supervision & Compliance | Twice a year – summer & fall | Twice a year – summer & fall | Twice a year – summer & fall | Twice a year – summer & fall |
| Trend | Every 5 years | Every 5 years | N/A | Every 5 years |
| Utilization | 3 times per decade | 3 times per decade | N/A for cattle grazing As needed for wildlife | 3 times per decade |
| Cole Browse | Every 5 years | Every 5 years | N/A for cattle grazing As needed for wildlife | Every 5 years |
| **Noxious Weeds** | | | | |
| Weed Treatment Effects | Every Year | Every Year | Every Year | Every Year |

| | | | | |
|---|---|---|---|---|
| Post-project weed surveys | N/A | Annually for three years after project implementation | Annually for three years after project implementation | Annually for three years after implementation & every 3 years for high use |
| **Recreation** | | | | |
| Limits of Acceptable Change | Annual data collection at recreation sites | Annual at recreation sites-- LAC data collection every decade | Annual at recreation sites-- LAC data collection every 15 years | Annual at recreation sites-- LAC data collection every decade |
| Boating Use Data Collection | Annual during primary use season & regular river patrols | Annual during primary use season-- new launch sites & regular river patrols | Annual during primary use season-- reduced level of patrols and visitor contact | Annual during primary use season-- new launch sites & regular river patrols |
| **Scenic Qualities** | | | | |
| Visual Resource Management | Project-by-project basis | Project-by-project basis | Project-by-project basis | Project-by-project basis |
| Overall Scenic Quality | Initial study will be conducted within 1 year of the approval of the Klamath River Management Plan-- Follow up studies will be conducted at a regular interval, every 3-5 years | | | |
| **Soils** | | | | |
| Bulk Density & Areal Extent Disturbance | 20% of ground-disturbing projects on resource area | 20% of ground-disturbing projects on resource area | 20% of ground-disturbing projects on resource area | 20% of ground-disturbing projects on resource area |
| **Special Status Plants** | | | | |
| Survey Implementation | Prior to implementation of ground-disturbing projects | | | |
| Population Monitoring | Initial data collection would precede implementation of the restoration action. Data would be collected annually for the first three years after implementation. Thereafter, data would be collected every three to five years. | | | |
| **Vegetation** | | | | |
| Photo Points | Initial data collection would precede implementation of vegetative treatments. | | | |

| | | | | |
|---|---|---|---|---|
| | Data would be collected in the first, fifth, and tenth years after implementation. Thereafter, data would be collected every ten years. | | | |
| Silviculture Exams | Approximately 120 plots per decade | Approximately 450 plots per decade | Approximately 700 plots per decade | Approximately 460 plots per decade |
| Riparian Vegetation | Every 3 years for 1 decade after treatment | Every 3 years for 1 decade after treatment | Every 3 years for 1 decade after treatment | Every 3 years for 1 decade after treatment |
| **Watershed** | | | | |
| Water Quality | Oregon Department of Environmental Quality | Oregon Department of Environmental Quality | Oregon Department of Environmental Quality | Oregon Department of Environmental Quality |
| OHV Use | Informal schedule | Informal schedule | Informal schedule | Informal schedule plus 4 days field visits per year |
| Water Temperature | Every year | Every year | Every year | Every year |
| Macroinvertebrate Sampling | Every 2 years | Every 2 years | Every 2 years | Every 2 years |
| Geomorphic Response | N/A | Prior to project implementation, after first winter, after first flood greater than 3,300 cfs, and after subsequent large (recurrence interval of approximately 5 years) flood events (or every 5 years, if no large floods) | | |
| Aquatic CWD Tracking | N/A | Immediately after project implementation, after first winter, after first flood greater than 3,300 cfs, and after subsequent large (recurrence interval of approximately 5 years) flood events (or every 5 years, if no large floods) | | |
| Channel Substrate | N/A | Prior to project implementation and every year thereafter | | |
| Water Table Depth | N/A | Every Year | Every Year | N/A |
| **Wild Horses** | | | | |
| Population Census | Every Year | Every Year | Every Year | Every Year |
| **Wildlife** | | | | |
| Eagles | Oregon State University Cooperative Study | Oregon State University Cooperative Study | Oregon State University Cooperative Study | Oregon State University Cooperative Study |

| | | | | |
|---|---|---|---|---|
| Peregrines (Baseline to 2005) | Every decade | Every 5 years | Every decade | Every Year |
| Big Game & Upland Game | State Agencies | State Agencies | State Agencies | State Agencies |
| Neotrops & Landbirds—Various Methods | N/A | N/A | 1 Year in Every decade | N/A |
| Neotrops & Landbirds—Various Methods (Baseline to 2006-2008) | 2 Consecutive Years in Every decade | 2 Consecutive Years in Every decade | 2 Consecutive Years in Every 5 Years | 2 Consecutive Years in Every 5 Years |
| Herptiles--Pond turtles | Every 2 years | Every year | Every 5 years | Every year, several times per month at different daily times |
| Herptiles--Area search/ Various Methods | Every decade | Every 5 years | Every 5 years | Every decade |

**Table M-3. Monitoring costs for the Upper Klamath River Management Plan**

| Monitoring Activities | Alternative 1 | Alternative 2 | Alternative 3 | Alternative 4 |
|---|---|---|---|---|
| **Cultural Resources** | | | | |
| Human Pressure on Cultural Sites | $0 | $5,000/decade | $0 | $5,000/decade |
| Site Preservation Treatment | $0 | $5,000/decade | $5,000/decade | $5,000/decade |
| Mitigation | Initially - $5,000<br>After 1st year - $700 | Initially - $5,000<br>After 1st year - $700 | Initially - $5,000<br>After 1st year - $700 | Initially - $5,000<br>After 1st year - $700 |
| Native American Consultation and coordination | $2,500/decade | $2,500/decade | $2,500/decade | $2,500/decade |
| **Fire and Fuels** | | | | |
| Photo Points | Refer to Vegetation Photo Points | Refer to Vegetation Photo Points | Refer to Vegetation Photo Points | Refer to Vegetation Photo Points |
| Stand Exams | Included in Vegetation Stand Exams | Included in Vegetation Stand Exams | Included in Vegetation Stand Exams | Included in Vegetation Stand Exams |
| **Fish** | | | | |
| Spawning Surveys | $0 | $5,000/year - no substrate samples | $10,000/year – with substrate samples | $5,000/year - no substrate samples |
| Habitat Surveys | $30,000 to resurvey Klamath River ($1,400 per mile) | | | |
| Migration Surveys | $0 | Trapping survey $25,000 per year | Radio-telemetry $50,000 first year and $25,000 per additional year | Trapping survey $25,000 per year |
| Fisheries Assessment | $0 | Combined with migration study | Combined with migration study; add $5,000 for additional sites | Combined with migration study |
| Creel Surveys | $0 | $60,000/year active creel | $5,000/year passive creel | $60,000/year active creel |
| **Grazing** | | | | |
| Use Supervision & Compliance | $3,000/decade | $3,000/decade | $3,000/decade | $3,000/decade |
| Trend | $1,000/decade | $1,000/decade | $0 | $1,000/decade |
| Utilization | $1,000/decade | $1,000/decade | $0 | $1,000/decade |
| Cole Browse | $1,000/decade | $1,000/decade | $0 | $1,000/decade |
| **Noxious Weeds** | | | | |
| Weed Treatment Effects | $2,250/year | $4,500/year | $4,500/year | $4,500/year |
| Post-project weed surveys | $0 | $1,200/year | $2,000/year | $1,500/year |
| **Recreation** | | | | |
| Limits of Acceptable Change | $500/year | $15,000/year (2013-2014) | $10,000/year (2018-2019) | $15,000/year (2013-2014) |
| Boating Use Data Collection | $7,500/year | $10,000/year | $7,500/year | $10,000/year |

| | | | | |
|---|---|---|---|---|
| **Scenic Qualities** | | | | |
| Visual Resource Management | $3,000/project | $3,000/project | $3,000/project | $3,000/project |
| Overall Scenic Quality | Initial study - $2,000 Every 3-5 years - $2,000 | Initial study - $2,000 Every 3-5 years - $2,000 | Initial study - $2,000 Every 3-5 years - $2,000 | Initial study - $2,000 Every 3-5 years - $2,000 |
| **Soils** | | | | |
| Bulk Density & Areal Extent Disturbance | $10,000/decade | $20,000/decade | $30,000/decade | $20,000/decade |
| **Special Status Plants** | | | | |
| Survey Implementation | $500/year | $1,000/year | $1,500/year | $1,000/year |
| Population Monitoring | $450/year | $675/year | $900/year | $675/year |
| **Vegetation** | | | | |
| Photo Points | Initially - $2,000 First, fifth, and tenth years - $1,000 - Thereafter every ten years - $1,000 | | | |
| Silviculture Exams | $2,250/decade | $8,450/decade | $13,125/decade | $8,625/decade |
| Riparian Vegetation | $9,000/decade | $9,000/decade | $9,000/decade | $9,000/decade |
| **Watershed** | | | | |
| Water Quality | $0 | $0 | $0 | $0 |
| OHV Use | Occurs as part of regular duties | Occurs as part of regular duties | Occurs as part of regular duties | $1,000 |
| Water Temperature | $7,500/decade | $7,500/decade | $7,500/decade | $7,500/decade |
| Macroinvertebrate Sampling | $50,000/decade | $50,000/decade | $50,000/decade | $50,000/decade |
| Geomorphic Response | N/A | $20,000/decade | $20,000/decade | $20,000/decade |
| Aquatic CWD Tracking | N/A | $7,000/decade | $10,000/decade | $5,000/decade |
| Channel Substrate | N/A | $25,000/decade | $25,000/decade | $25,000/decade |
| Water Table Depth | N/A | $17,000/decade | $17,000/decade | N/A |
| **Wild Horses** | | | | |
| Population Census | $500/decade | $500/decade | $500/decade | $500/decade |
| **Wildlife** | | | | |
| Eagles | Cooperative--BLM portion is $2000/year | Cooperative--BLM portion is $2000/year | Cooperative--BLM portion is $2000/year | Cooperative--BLM portion is $2000/year |
| Peregrines (Baseline to 2005) | $100/year | $200/year | $100/year | $1,000/year |
| Big Game & Upland Game | $0 | $0 | $0 | $0 |
| Neotrops & Landbirds—Various Methods | N/A | N/A | $40,000 | N/A |
| Neotrops & Landbirds—Various Methods (Baseline to 2006-2008) | $14,400/year | $28,800/year | $28,800/year | $28,800/year |
| Herptiles--Pond turtles | $1,000/year | $2,000/year | $400/year or | $4,000/year |
| Herptiles--Area search | N/A | $1,600/year | $1,600/year | $1,600/year |

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# Appendix O – Index

# Appendix P – List of Agencies Receiving This EIS

The Council on Environmental Quality requires that certain agencies obtain comments from Federal, State, and Local agencies, and Tribes. The different agencies have jurisdiction by law or special expertise on environmental quality issues addressed in an EIS.

**Required Agencies**
Environmental Protection Agency

Office of Environmental Project Review

Office of Public Affairs

Natural Resources Library

Bureau of Land Management Director

**Other Federal Agencies**
USDA Forest Service
- Winema National Forest
- Klamath National Forest
- Goosenest Ranger District
- Six Rivers National Forest

USDI Bureau of Land Management
- Oregon/Washington State Office
- California State Office
- Medford District
- Prineville District
- Lakeview District
- Redding Field Office
- National Training Center

US Bureau of Mines
- Branch of Mineral Assessment
- Western Field Operations Center

USDI Bureau of Reclamation
- Denver Federal Center
- Klamath Basin Area Office
- Washington D.C. Office

USDI Fish and Wildlife Service
- Division of Environmental Coordination
- Klamath Basin Area Office

USDI Minerals Management Service, Offshore Environmental Assessment Division

USDI National Park Service
- Division of Environmental Compliance (762)
- Crater Lake National Park

US Air Force
- Office of Deputy A/S of the
Environment, Safety, Occupational Health
- HQ-USAF/LEEV, Environmental Division

Army Corps of Engineers, North Pacific Division

Department of Energy, Office of Environmental Compliance (EH-23)

Environmental Protection Agency
- Office of Federal Activities
- Environmental Review Coordinator, EPA Region IX
- Environmental Review Coordinator, EPA Region X

Federal Energy Regulatory Commission, Division of Environmental Analysis, Hydro Power Licensing

Bureau of Indian Affairs, Montague, CA

**State and Local Agencies**

California Resources Agency
California Department of Boating & Waterways
California Department of Fish and Game
California Department of Forestry
California Department of Water Resources
California Environmental Protection Agency
California State Lands Commission
California Water Resources Control Board

Oregon Parks and Recreation Department
Oregon Department of Environmental Quality
Oregon Water Resources Department
Oregon Department of Transportation
Oregon Governor's Forest Planning Team

**Indian Tribes and Native American Groups**
Klamath Tribes
Hoopa Valley Reservation
Karuk Tribe of California
Quartz Valley Indian Reservation
Shasta Nation

**County and Local Government**
Klamath County Board of Commissioners
Siskiyou County Board of Supervisors
Modoc County Board of Supervisors